SITE DISCOVERY AND ASSESSMENT PROGRAM

ANNUAL FIELD SAMPLING PLAN

FOR THE

WEST COUNTY ROAD 112 GROUNDWATER PLUME SITE
2604 W CR 112
Midland, TEXAS

Implemented by:

Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg D
Austin, Texas 78753
512-239-0158

October 2009

Approved by:

10/25/09
Danielle Soule (Date)
TCEQ Project Manager

CJD for
ROBERT MUSICK 11-2-09
Robert Musick (Date)
Team Leader

11/2/09
Lloyd Johnson (Date)
Quality Assurance Specialist

9236949

Contractor Acknowledgement

I am responsible for some or all of the contracted activities conducted under this field sampling plan (FSP). I have reviewed this W County Road 112 FSP and the *TCEQ Quality Assurance Project Plan for the Superfund Program* (Document No. 200919.6) (QAPP). I understand this FSP and the QAPP together constitute the sampling and analysis plan for the site, and I understand that the terms of the current Remedial Investigation and Removal and Remedial Services Contract apply. I understand this FSP is in effect for one year from the date of TCEQ's approval of the FSP. I understand the project objectives and acknowledge receipt of the plan.

John Sullivan 11/2/09	S. Paranjape 11/2/09
John Sullivan (Date)	Sushama Paranjape (Date)
Project Manager	Quality Assurance Officer
SHAW	SHAW

Laboratory Acknowledgement

I am responsible for some or all of the contracted activities conducted under this field sampling plan (FSP). I have reviewed this W County Road 112 FSP and the *TCEQ Quality Assurance Project Plan for the Superfund Program* (Document No. 200919.6) (QAPP). I understand the FSP and the QAPP together constitute the sampling and analysis plan for the site, and I understand that the terms of the current Remedial Investigation and Removal and Remedial Services Contract apply. I understand this FSP is in effect for one year from the date of TCEQ's approval of the FSP. I understand the project objectives and acknowledge receipt of the plan.

10/30/09

Brent Barron (Date)
Laboratory Manager
Xenco Laboratories

List of Figures

List of Tables

List of Appendices

List of Acronyms

BGL	Below ground level
COC	Chemical of concern
DQO	Data quality objectives
DUS	Data usability summary
EDD	Electronic data deliverable
EPA	U. S. Environmental Protection Agency
FB	Field blank
FD	Field duplicate
FSP	Field sampling plan
GPS	Global positioning system
HASP	Health and safety plan
HRS	Hazard Ranking System
H&SO	Health and Safety Officer
IDW	Investigation derived waste
IRA	Immediate removal
MCL	Maximum contaminant level
MDL	Method detection limit
MQL	Method quantitation limit
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MS/MSD	Matrix spike/matrix spike duplicate
PCL	Protective concentration limit
PM	Project manager
ppb	Parts per billion
ppm	Parts per million
PWS	Public water System
QAPP	*TCEQ Quality Assurance Project Plan for the Superfund Program*
QA	Quality assurance
QC	Quality control
RCRA	Resource Conservation and Recovery Act
SDL	Sample detection limit
SAP	Sampling and analysis plan
SOP	Standard operating procedure
SSDAP	Superfund Site Discovery and Assessment Program
SVOC	Semivolatile organic compound
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
VOA	Volatile organic analysis
VOC	Volatile organic compound
WO	Work order

Introduction

This site-specific field sampling plan (FSP) and the *TCEQ Quality Assurance Project Plan for the Superfund Program* (Document No. 200919.6) (QAPP) constitute the SSDAP sampling and analysis plan (SAP) for the state lead domestic groundwater well sampling activities at the West County Road 112 Groundwater Site (the Site). This SAP shall function as a stand-alone project document for the Site. The work associated with this FSP is being conducted under Contract RIRS 582-6-49221 or the current active contract. The reference documents followed in the preparation of this FSP are EPA/540/G-91/013 "Guidance for Performing Preliminary Assessments under CERCLA", EPA/540-R-92-021 "Guidance for Performing Site Inspections under CERCLA", and the documents listed in Element A.1 of the QAPP.

Because the QAPP is revised annually with the anniversary date of June 1, sample collection conducted after the June 2010 revision of the QAPP will be performed in accordance with the requirements of the revised QAPP.

This FSP will be in effect from November 1, 2009 through October 31, 2010 for monitoring the effectiveness of the removal action, i.e., the filtration systems installed, and the stability of chromium concentrations in wells with chromium detected below the MCL, on a quarterly basis or as determined by the TCEQ project manager. Beginning September 2010, this FSP will be reviewed and approved by October 31 on an annual basis. If at any time the scope of work covered by this FSP changes, this FSP will be revised to address the changes. Changes in the scope of work include change(s) to key project personnel, e.g., TCEQ project manager or the contractor or laboratory, changes in the funding mechanism, or change(s) in the purpose or method of sampling. Sampling additional wells located within the study boundary, i.e., the area included inside the red boundary line demarcated on Figure 3, as revised, does not constitute a change in scope.

1.1 Purpose

Immediate Removal Sampling

An immediate removal (IR) sampling event will be conducted to:

- identify domestic water wells impacted with chromium concentrations greater than the maximum contaminant limit (MCL) for chromium of 0.1 mg/L;
- verify the removal actions taken, i.e., filtration systems installed, are effective at reducing the chromium concentration in the groundwater filtrate, i.e., the water leaving the filter system, to levels below the MCL;
- determine the stability of chromium concentrations in domestic water wells with chromium detected below the MCL; and

- determine the concentrations of organic chemicals and total petroleum hydrocarbons at select sample locations determined by the TCEQ project manager.

1.2 Project Organization

The project team for the Site comprises the TCEQ's project manager (PM), quality assurance (QA) specialist, and health and safety officer (H&SO), and the contractor's PM, QA specialist or officer, H&SO, and its subcontracted laboratories, providing analytical services for this Site, and the data reviewer. The lines of authority and communication for the project are presented in the project organization chart in Figure 1.0.

In addition to the roles and responsibilities set forth in Element A.4 of the QAPP, the following additional responsibilities are assigned:

The TCEQ Project Manager is responsible for:

- Determining the project data quality objectives (DQOs);
- Planning the project and completing the activities described in this FSP;
- Collecting and documenting the circumstantial information, e.g. photographs, and evidence of owner/operator information available at the Site, to provide information for cost recovery activities, unless delegated to the contractor's PM;
- Preparing of the work order (WO) and necessary amendments;
- Overseeing the activities of the contractor;
- Verifying the work is complete according to the WO, this FSP, and the QAPP;
- Reviewing and approving of contractor invoices, unless delegated otherwise; and
- Distributing the approved SAP, and each addendum, to the TCEQ project personnel on the distribution list.

The TCEQ QA Specialist is responsible for:

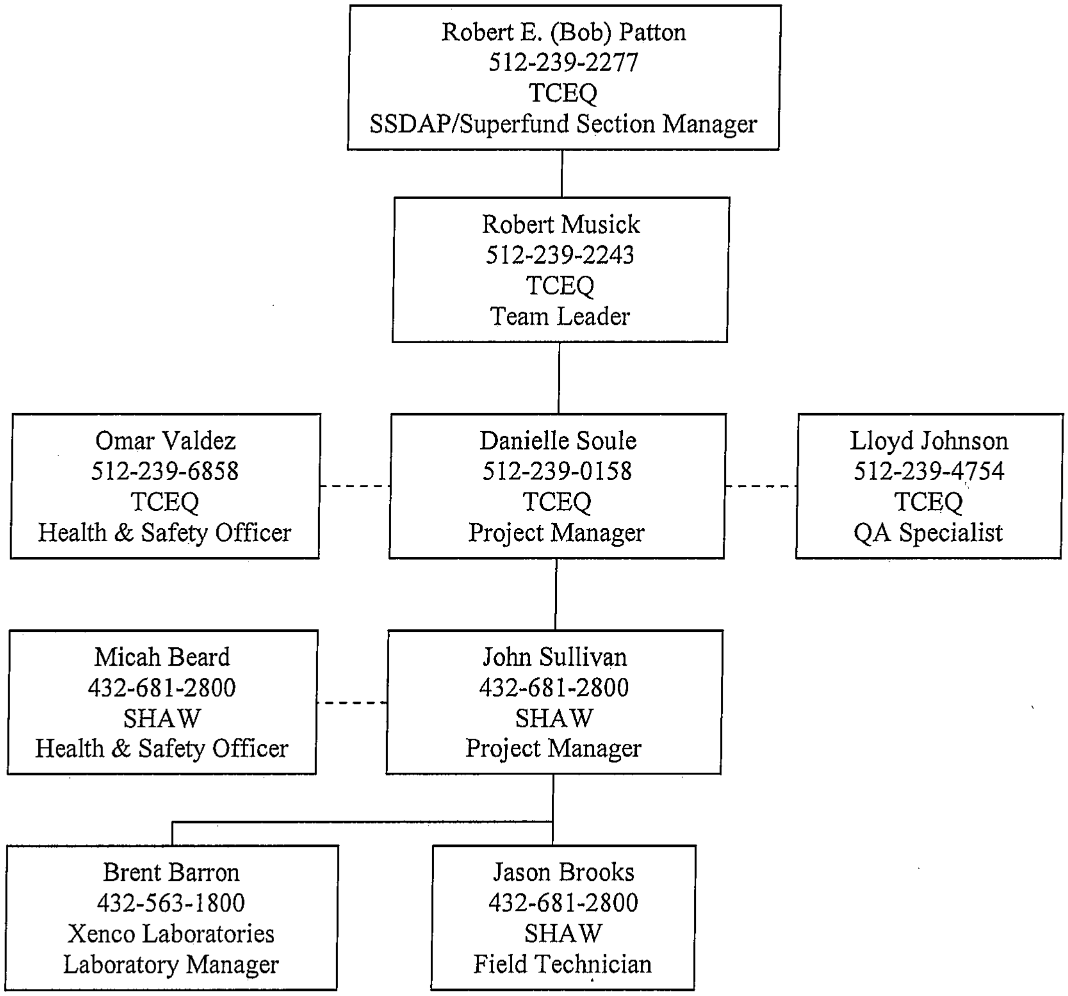
- Reviewing and approving the FSP for the project.
- Reviewing the laboratory submittals specified in the WO; and
- Ensuring the project DQOs and measurement quality objectives (MQOs) were met by the contractor and analytical laboratory
- Communicating with the contractor regarding analytical issues.

The Contractor is responsible for:

- Distributing the approved SAP, and each addendum, to the contractor's personnel and subcontractors responsible for the work performed during this sampling event;
- Securing the signature from the laboratory documenting the laboratory has reviewed the analytical specifications of the FSP and QAPP and can meet the project objectives. The signature can be secure by original hard copy, fax, or by PDF transmittal via electronic mail;

- Performing work, including work performed by the laboratories and all subcontractors, which meets the requirements of the contract, WO and QAPP necessary to fulfill the DQOs;
- Reviewing the analytical data;
- Issuing data review memoranda to the TCEQ PM that include a section on usability of the data;
- Providing appropriate personnel to complete the project within the required timeframe;
- Ensuring all onsite personnel adhere to the site-specific HASP;
- Communicating with the TCEQ PM and following any specific instructions issued;
- Communicating agreed upon changes to its subcontractors; and
- Timely submittal of invoices.

Figure 1: Project Organization Chart



2.0 Site and Project Summary

2.1 Site Description and Background

The Site is a groundwater plume contaminated with chromium at concentrations exceeding the federal MCL and the Texas Risk Reduction Program (TRRP) Protective Concentration Level (PCL) for residential groundwater ingestion in domestic water wells. The MCL and PCL is 0.1 mg/L. Based on current information, the concentration of hexavalent chromium ranges from 0.006 mg/L to 5.2 mg/L. The source of the hexavalent chromium has not been identified at this time.

The Site is located at 2604 West County Road 112, Midland, Texas, and is presented in Figure 2, Site Location Map. The Site is bounded on the east, west, and south by residential/light commercial properties and to the north by industrial properties. City water is available as a primary water source north of IH 20; however, in the area to the south of IH 20 (the location of the Site), groundwater is the sole source of drinking water. Several households in this area purchase drinking water, but all households use the groundwater for bathing and other domestic purposes. No water lines are within a quarter mile of the site. In the area, the depth to the drinking water aquifer ranges from approximately 60 to 100 feet below the ground surface.

2.2 Previous Investigations

The Site was discovered by the TCEQ in April 2009. As of August 10, 2009 the TCEQ has sampled 138 drinking water wells within 1.5 miles of the Site. Figure 3 indicates the locations of the private drinking water wells sampled to date. Sample data collected to date indicate the plume with chromium concentrations exceeding the MCL is defined to the west but not defined to the east, south, and north.

2.3 Chemicals of Concern

- Total chromium

*VOCs were detected in two wells at the Site; however, the VOCs detected in the wells are attributed to another source. Organic chemical analyses may be performed at filter systems having the potential to be impacted with the hydrocarbons in the groundwater.

2.4 Schedule of Activities

The field sampling activities will begin in November 2009 and continue through October 2010. Approved work orders and subsequent work order amendments will identify the domestic water well sampling activities to be conducted during each sampling event covered by this FSP. Due dates for contract deliverables will be specified in the WOs and amendments. If additional work is added by the TCEQ beyond the proposed scope of a WO, then the due dates of the project tasks listed in the WOs will be modified accordingly in the amended WOs or as directed by the TCEQ PM.

3.0 Analytical Requirements and Data Quality Objectives

3.1 Analytical Requirements and Data Review Requirements

3.1.1 Analytical Requirements

Table 3.1 lists the COCs and the analytical levels of concern in groundwater for this sampling event. Although not directly COCs at the Site, analysis for volatile organic compounds (VOCs), Semivolatile organic compound (SVOCs) and total petroleum hydrocarbons (TPH) may be conducted. The hazardous substance benchmark is taken from the Superfund Chemical Data Matrix (SCDM) and used to evaluate the Site under the federal Hazard Ranking System rule (40 CFR Part 300). The TRRP PCL is taken from the March, 2009, TRRP Tier 1 Groundwater PCL tables and is used to determine if immediate action is warranted at the Site. The residential groundwater ingestion TRRP PCL will be used for this sampling event. All drinking water samples will be analyzed for total chromium. Analysis for hexavalent chromium will be conducted as directed by the TCEQ PM.

Table 3.1 Levels of required performance Groundwater Samples (mg/L)

COC	Test Method	Laboratory MQL	Laboratory MDL*	Hazardous Substance Benchmark**	TRRP PCL ***
Total Chromium	6010	0.05	0.015	0.1000	0.1
VOCs	8260	~0.001	~0.0005	varies	varies
Tetrachloroethene	8260	0.001	~0.0005	0.0013*****	0.005
Trichloroethene	8260	0.001	~0.0005	0.00021*****	0.005
Cis- & trans- Dichloroethene	8260	0.001	~0.0005	0.07 and 0.01	0.07 & 0.005
Vinyl Chloride	8260	0.001	~0.0005	0.002	0.002
SVOCs	8270	~0.01	~.001	varies	varies
TPH	1005	5	~2.5	N/A	0.98

NA Not applicable to the project objectives for this sampling event

* If the MQL exceeds either the PCL or the benchmark, the laboratory will include the MDL supported by the detectability check sample (DCS).

** The Superfund Chemical Data Matrix (SCDM) is the only source used for hazardous substance benchmarks.

*** The Texas Risk Reduction Program (TRRP) protective concentration level (PCL) is taken from the March, 2009, TRRP PCL tables. The residential groundwater ingestion TRRP PCL will be used for this sampling event.

3.1.2. Data Review and Validation

The laboratory shall complete the data package as specified in QAPP Element A.9.2 and shall review the data as specified in QAPP Element D.2.1.1. The contractor will provide the TCEQ project manager with an electronic data deliverable (EDD) that contains the fields listed in Appendix B. The contractor shall complete an independent review of the data and, if requested, validate the data, as specified in QAPP Elements D.2.1.2 and D.2.1.3, respectively.

3.1.2.1 Data Review and Data Validation Memoranda

The data review memoranda, and, if requested, the data validation memoranda, shall be completed pursuant to the contract requirements.

3.1.2.2 Data Usability Summary

The DUS shall be completed as specified in QAPP Element D.2.3.2, if requested by the TCEQ project manager.

3.2 Sampling Objectives and Data Quality Objectives

3.2.1 Immediate Removal Sampling Objectives

The data collected from this sampling event will be used to:

- Determine the effectiveness of the installed filtration systems to deliver water with chromium concentrations below the MCL.
- Identify the domestic water wells, for which access is granted to the TCEQ, with chromium concentrations greater than the MCL of 0.1 mg/L total chromium within the red boundary indicated on Figure 3, as revised.
- Determine the stability of chromium concentrations in wells with chromium concentration detected below the MCL.

4.0 Sampling Plan Design

The sample locations for each event are selected based on the following:

- *Wells with filtration systems in place* -- These wells have historically shown concentrations of chromium exceeding the MCL.
- *Newly accessible wells to the south/southeast of the Site* – Based on historical data, the migration pathway of the plume appears to be to the south/southeast. Based on the regional geology and local features, e.g., the proximity of Monahans Draw to the south/southeast, paleochanneling is suspected to be influencing the flow path of the plume. Wells within this suspected pathway have the potential to be impacted by the migration of the plume over time. No alternate source of drinking water is available in this area.

- *Newly accessible wells to the east and south/southwest of the known plume* -- These wells are in proximity to wells having historical detections of chromium in the groundwater and may be in the suspected preferential pathway(s) established by the paleochannels present in the area, but the connection has not been made apparent in data collected to date. No alternate source of drinking water is available in these areas.
- *Previously sampled wells downgradient from the known plume and potentially impacted by the suspected preferential pathway* – The concentration of chromium in these wells is below the MCL, but the stability in the concentrations over time needs to be established.
- *Newly accessible wells to the north of the known plume.* These wells appear at this time to be upgradient from the known plume, and city water is available in this area.

4.1 Sampling Locations and Rationale

The planned sample locations will be determined for each sampling event and the approximate number of samples to be collected will be included in the WO. The rationale for all samples is to determine or to monitor the concentration of chromium in the groundwater and in the filtrate, if applicable. Exact locations of sample collection and any deviations will be noted in the field sampling notes. At the discretion of the project manager, the area wells may be screened for VOCs, SVOCs, and TPH to identify other constituents in the groundwater with the potential to interfere with the anion exchange filtration systems.

4.2 Sample Analysis

The analytical methods for this FSP are as follows:

1. EPA Method SW846-6010
2. EPA Method SW846-8270
3. EPA Method SW846-8260
4. TCEQ Method 1005

The project requirements and preparatory methods for analytical methods 1 through 4 are in Element B5 in the *TCEQ Quality Assurance Project Plan for the Superfund Program* (Document No. 200919.6) (QAPP).

4.3 Field Quality Control Samples

Field QC samples will be collected at the frequency specified in Table 4.2 below and in accordance with SOP 6.5 (Collection of QA/QC Samples). SOP 6.5 Sections 3.1.3.3.a and 3.1.3.3.b are modified to require complete filling of the sample container, and then complete filling of the duplicate sample container. This procedure is used for groundwater, surface water, soil, and sediment samples.

Table 4.2 Frequency of Collection of Field Quality Control Samples	
Type of QC Sample	**Frequency of Collection**
Field Duplicates (FD)	1 per day per 10 project samples of each matrix. Collect the field duplicate at a sample location known or suspected to be contaminated with COCs, immediately after the sample is collected. Change the field duplicate sample locations for each sampling event.
Temperature Blank	1 per cooler.
Matrix Spike/matrix spike duplicate (MS/MSD)	1 per 20 project samples collected. Collect double volume at locations with chromium concentrations below and near to the MCL of 0.1 mg/L. Change the MS/MSD sample locations for each sampling event.
Trip blank	1 per cooler containing samples for volatile analysis. The sample vials will be filled with reagent grade water before sample containers are transported to the field. Trip blanks should be prepared by the laboratory and included in the cooler(s) taken to the field.
Field blank	1 per day per 20 samples of each matrix when analyzing for VOCs or other suspected airborne COCs
Quality Control Split Sample	A double volume of a sample for chromium analysis collected at one sample location, split into two individual samples, and sent by the TCEQ project manager to a laboratory independent of the project. The frequency of this QC sample collection is determined by the TCEQ project manager in consultation with QA Specialist. Split samples should be collected from several locations if any split samples are to be analyzed, labeled as the sample location followed by an "S," marked "HOLD" on the custody document, shipped to the QC laboratory, and held at that location until directed otherwise by the TCEQ project manager. This procedure will not allow the contractor and the primary laboratory to remain blind to the split sample(s) actually analyzed by the QA laboratory.

5.0 Sampling Methods and Sample Handling

5.1 Field Sampling Procedures

All samples will be collected in accordance with the QAPP, this FSP and the SOPs listed in this FSP. All field activities, measurements, and field observations will be recorded in the field logbook. The FSP Section 5.1 below describes sampling procedures required for this sampling event.

The GPS location information will be taken and recorded for all sampled points during the sample event as specified in Section 6.2 of this FSP.

5.1.1 Sample Collection

The contracted sampling crew will be responsible for sample collection activities as prescribed in this SAP and for communicating with the TCEQ project manager. Field sampling personnel will wear nonlubricated nitrile disposable gloves, or other suitable disposable gloves, during the handling of all sampling equipment and during sampling. The disposable gloves will be changed between each sample location. Dedicated equipment will be used for the sampling events covered under this FSP.

5.1.1.1 Groundwater Samples

The sampling objective is to obtain a representative water sample from the groundwater bearing zone of interest without mixing the sample with stagnant (standing) water in the well casing. The sampling objective for groundwater wells with filtration systems is to check the effectiveness of the filtration system.

5.1.1.2.1 Groundwater Samples from a Private Drinking Water Well.

Private drinking water wells will be purged in accordance with SOP No. 7.9 (Purging a Drinking Water Well). If the PM determines that the well is used daily, the required time that the sampling faucet or port must be allowed to run can be reduced from at least 15 minutes to at least 5 minutes prior to collecting temperature, pH, and conductivity field measurement readings. Once well purging is complete, a groundwater sample will be collected in accordance with SOP No. 7.10 (Sampling a Drinking Water Well). All groundwater sampling activities will be entered in the logbook.

5.1.1.2.2 Groundwater Samples from a Public Supply Well

The groundwater samples will be collected from a faucet or port at or near the wellhead. The samples should be collected upline of chlorinators, storage tanks, and pressure tanks. The samples should be collected upline of chlorinators, storage tanks, and pressure tanks. The field team will note in the logbook the location of the sampled point relative to the filtration and treatment systems and storage and pressure tanks. Prior to sampling, the sampling faucet or port will be allowed to run for at least 15 minutes to purge the well.* Temperature, pH, and conductivity field measurement readings will be collected using a calibrated instrument and will be taken at intervals of at least 5 minutes, while the faucet or port is running. Well purging is considered complete after three consecutive readings consistent within +/- 10% conductivity, +/- 1 C° temperature, and +/-0.5 for pH have been collected. The measurements will be collected in accordance with SOP No. 7.5 (Measurement of Field Parameters). Once well purging is complete, a groundwater sample will be collected. All ground water sampling activities will be entered in the logbook.

* If the field team contacts the owner/operator to confirm the public supply well has been continuously running for three or more hours prior to the sampling event, the field team can forego the 15 minutes and begin collecting temperature, pH, and conductivity field measurements at 5 minutes intervals, using a

calibrated instrument, until three consecutive readings are consistent within +/- 10% conductivity, +/- 1 C° temperature, and +/-0.5 for pH.

5.2 Sample Containers, Sample Preservation, and Holding Time

Sample containers, sample preservation requirements, sample volumes, and holding times are specified in Table B2-1 of the QAPP.

5.3 Chain-of-Custody Procedures

The following is applicable to all environmental and field QC samples collected under this SAP. When the sample is introduced into the sample container, the lid or cap shall be tightened onto the container, and a custody seal shall be immediately wrapped around the lid or cap of the sampling container.

Custody seals will be affixed to every sample jar or container and to every sample shipping cooler with the following exception for groundwater samples collected for volatile analysis:

> Groundwater samples collected for volatile analysis will be collected in the three 40-mL VOA vials. The caps will be screwed on tightly, and the vials wiped to remove any water or debris. All three vials will be placed in a resealable baggie, the bag will be sealed, and a custody seal will be placed across the bag's sealed opening. The bag will then be place on ice for storage and transport.

The custody seals shall not be broken until received by the laboratory. Custody documentation will be maintained using a chain-of-custody form that lists each sample and the individuals performing the sample collection, shipment, and receipt. A sample is considered in custody if one of the following conditions is met:

- In the actual possession of a member of the sampling team;
- In the view of a member of the sampling team, after being in physical possession;
- Locked so that no one can tamper with it, after having been in physical possession, or;
- In a secured area, restricted to authorized personnel.

The field sampling team will use the chain-of-custody records to document the collection, shipping, and delivery of the samples to the laboratory. The individual who has custody of the sample(s) in their possession will sign the chain-of-custody form relinquishing custody to the laboratory. The laboratory will immediately contact the contractor's PM if the chain-of-custody is not complete for samples received by the laboratory. The laboratory will keep the original chain-of-custody form in the project files at the laboratory and send a copy of the completed form in the data packages issued to the contractor.

The chain-of-custody form will include the following:

- The unique identification number of each sample;
- The time and date of collection of each sample;

- The number and type of containers of each sample;
- The matrix of each sample;
- The methods of preservation of each sample;
- The analytical methods to be used by the laboratory for each sample;
- A note identifying samples suspected of containing high concentrations of chemicals;
- If a common carrier is used to transport the sample cooler to the laboratory, the air bill number and the time and date custody of the samples was relinquished by the field personnel and the signature of that personnel;
- If a courier is used to transport the sample cooler to the laboratory, the time and date custody of the samples was relinquished to and accepted by the courier, the time and date the courier relinquishes custody to the laboratory and the signature of the courier;
- The time and date the laboratory accepts custody of the samples and the signature of the laboratory personnel accepting that custody; and
- The temperature of the temperature blank measured by the laboratory upon receipt.

6.0 Field Survey and Measurements

6.1 Property Access

Access agreements between landowners and TCEQ will be obtained prior to initiation of sample collection activities. Form TCEQ-10452 will be used to obtain written access agreements between landowners and TCEQ. In the event the TCEQ is unable to secure a written access agreement from a property owner, verbal agreement of granted access will be documented in the project field notes. If the property is abandoned or the owner cannot be reached, TCEQ Legal Division will determine the appropriate course of action to document access. Copies of the access agreements will be placed in the project file.

6.2 GPS Information

The contractor or TCEQ PM will record GPS locations of all sampling locations and other pertinent site features. The contractor will submit all GPS information to the TCEQ as specified in the WO. The GPS data shall be collected pursuant to SOP 17.1 (GPS Data Collection and Submission).

7.0 Additional Field Activities

7.1 Sample Identification and Documentation of Sampling Activities

Information regarding sample collection will be entered into the field logbook pursuant to SOP 6.1 (Field Activity Documentation and Reporting). The following information will be recorded in the TCEQ field logbook:

- Date and time of sample collection;
- Environmental matrix and sample type (e.g., soil composite or groundwater grab);

- Sample collection method;
- Sample preservation;
- Name of the person who collected the sample;
- Sample identification number and depth measured from surface of the environmental medium sampled;
- Field measurements made on the sample during and at the time of collection, e.g., photoionization readings using a photoionization detector (PID);
- When low-flow technology used, the flow rate, e.g., mL/min, as sample was collected;
- GPS file number;
- Photograph number;
- Date and time of photograph with a description of the purpose of the photograph, e.g. "This photo documents the sample collected at location X of material released to soil from the corroded and leaking drums in the drum storage area observed and documented in photos 2 & 3.";
- Name of the person who took the photograph and direction the person was facing when the photograph was taken;
- Relevant observations such as soil color, obvious staining, and weather conditions; and
- Deviations from the QAPP, FSP, or SOP.

Samples will be adequately marked for identification from the time of collection and packaging through shipping and storage. The sample identification scheme will include:

- Field sample ID;
- Well ID;
- Project name and number;
- Sampling date and time;
- Name of the sample collector;
- Method of sample preservation; and
- Laboratory analyses required.

Sample identification will be as follows:

- **Groundwater Samples**: Groundwater samples will be identified using the prefix "GW" followed by a sequential number;
- **Field Duplicate Samples**: For quality assurance purposes, the identification of duplicate samples will not include any information that may reveal to the laboratory the identity of the primary samples. The project manager will determine the labeling procedures for labeling duplicates and will record that procedure in the field logbook prior to the

sampling event. The TCEQ project manager will log duplicates in the field notebook at the time of collection for later cross-referencing purposes.

At each sampling location, the collection of the sample will be documented by photographing the sample collection point and by recording the location with certified GPS equipment operated by GPS certified TCEQ staff or contractor personnel. If certified GPS equipment is not available, the sample locations will be identified and method of identification and site sketch will be included in the field logbook.

7.2 Equipment Decontamination

If nondedicated sampling equipment is used, that equipment will be decontaminated prior to use and between each sampling location. A decontamination event will be performed at the beginning of the start of sample collection for the event and at the end of every day and an equipment rinsate sample collected as specified in Table 4.2. The TCEQ PM may modify the decontamination frequency if necessary. Decontamination of field equipment will be performed in accordance with SOP 1.5 (Decontamination), modified as follows:

Following Step 4 for large equipment and following Step 2 for small equipment in SOP 1.5 (Decontamination):

- Rinse all equipment with potable water;
- Clean equipment with a brush in a solution of laboratory grade detergent (Liquinox, Alconox, or equivalent);
- Rinse with potable water;
- If samples are for metals/cyanide analysis, rinse with 10% nitric acid solution (trace metals grade);
- Rinse with distilled or deionized water;
- Rinse with reagent grade isopropanol if analyzing for organic compounds;
- Rinse with deionized water;
- Allow equipment to completely dry, then collect an equipment rinsate sample using ultra-deionized water, seal the rinsate sample container with a custody seal, and place the sample in the shipment cooler;
- Place the equipment on clean plastic sheeting and allow to air dry; and
- If the equipment is not to be used immediately, place small equipment in plastic sealable bag and place a custody seal across the sealed opening of the bag.

7.3 Investigation Derived Waste

All investigation derived waste (IDW) will be handled in accordance with SOP 1.4 (Management of Investigation Derived Waste). The contractor will be responsible for collection, containerization and disposal of all IDW.

Purge waters from wells will be managed according to guidance provided in SOP No. 1.4 (Management of Investigation Derived Waste) and "Management of Investigation-Derived Wastes During Site Inspections", EPA/540/G-91/009, May 1991. The preference is to leave both RCRA hazardous and non-hazardous IDW on-site whenever it complies with regulations and does not pose any immediate threat to human health and the environment.

7.4 Site Restoration

The work site and sampling locations will be restored to their original condition in accordance with SOP 1.3 (Site Restoration). Efforts will be made to minimize impacts to work sites and sampling locations, particularly residential properties and those properties in or near sensitive environments.

7.5 Health and Safety

The contractor will develop a site-specific Health and Safety Plan (HASP) to meet the project objectives. During all sampling activities, contractor's personnel will adhere to the HASP to ensure that all sample collection and decontamination are done in a safe manner. The purpose of this HASP is to assign responsibilities, establish personnel protection standards, specify safe operating procedures, and provide for contingencies that may arise while conducting this investigation. TCEQ personnel will adhere to the HASP while onsite.

Prior to commencement of field activities, the contractor's designated H&SO will conduct a safety briefing to inform all personnel of the possible chemical and physical hazards. All personnel will be required to read and sign the HASP, and it will be readily available in the field at all times. The H&SO will conduct a daily safety meeting prior to initiating field work each day to advise workers of ongoing and new health and safety concerns. During the daily safety meeting, the H&SO will identify all potential health and safety risks present at the Site. The H&SO will record the subjects covered during each daily safety briefing, as well as personnel in attendance. These records will become part of the project files. The H&SO will verify all field personnel have completed "OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120)" training before beginning fieldwork and will verify at least one on-site worker has training in first aid and CPR.

While on-site during field activities, no personnel will eat, drink, or smoke, and all personnel will minimize hand to mouth contact.

7.6 Deviations, Modifications, and/or Departures from the FSP or QAPP

Each deviation, modification, and/or departure from this approved FSP or QAPP will be recorded, with a discussion of the rationale for each, in the field logbook.

8.0 Exceptions, Additions, and Changes to the TCEQ Superfund QAPP

Element C2 of the QAPP is revised to require the project manager to generate a summary memorandum to the file of field activities conducted each quarter under this FSP. The memorandum will summarize the information known about the Site, the quality of the data generated to date for the project for quarter, and the plans for future field work. Attached to the summary memorandum will be an updated data summary table and updated Site location map illustrating the study area and the locations of the wells sampled to date. The configuration of the map is at the discretion of the project manager. For example, to minimize congestion of the mapped information, the map could be divided into quadrants on the north/south east/west axes.

Element D2.1.3 of the QAPP is revised by this FSP to require validation of the project data on a frequency determined by the project manager in consultation with the QA Specialist.

Figure 2.0: Site Location Map

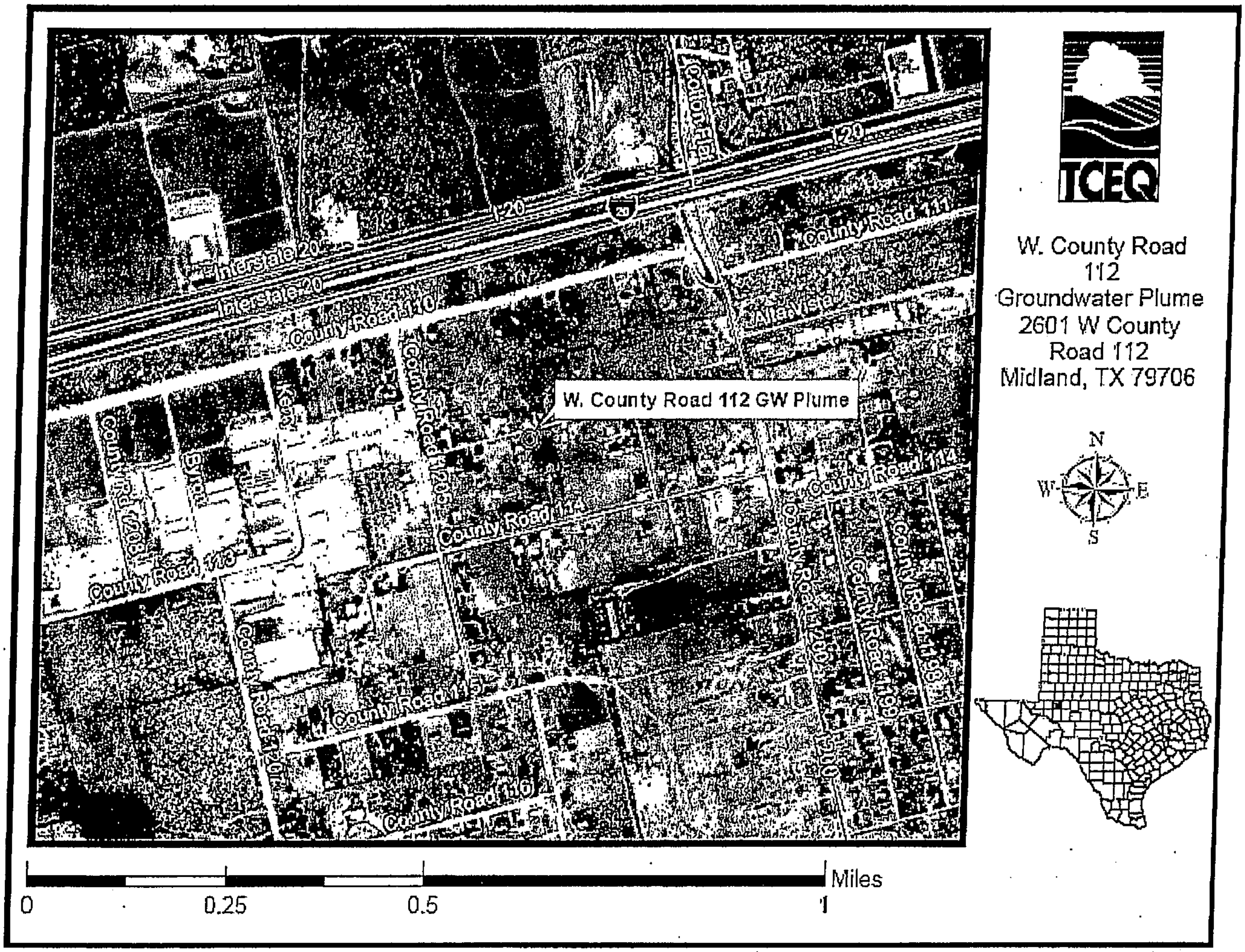
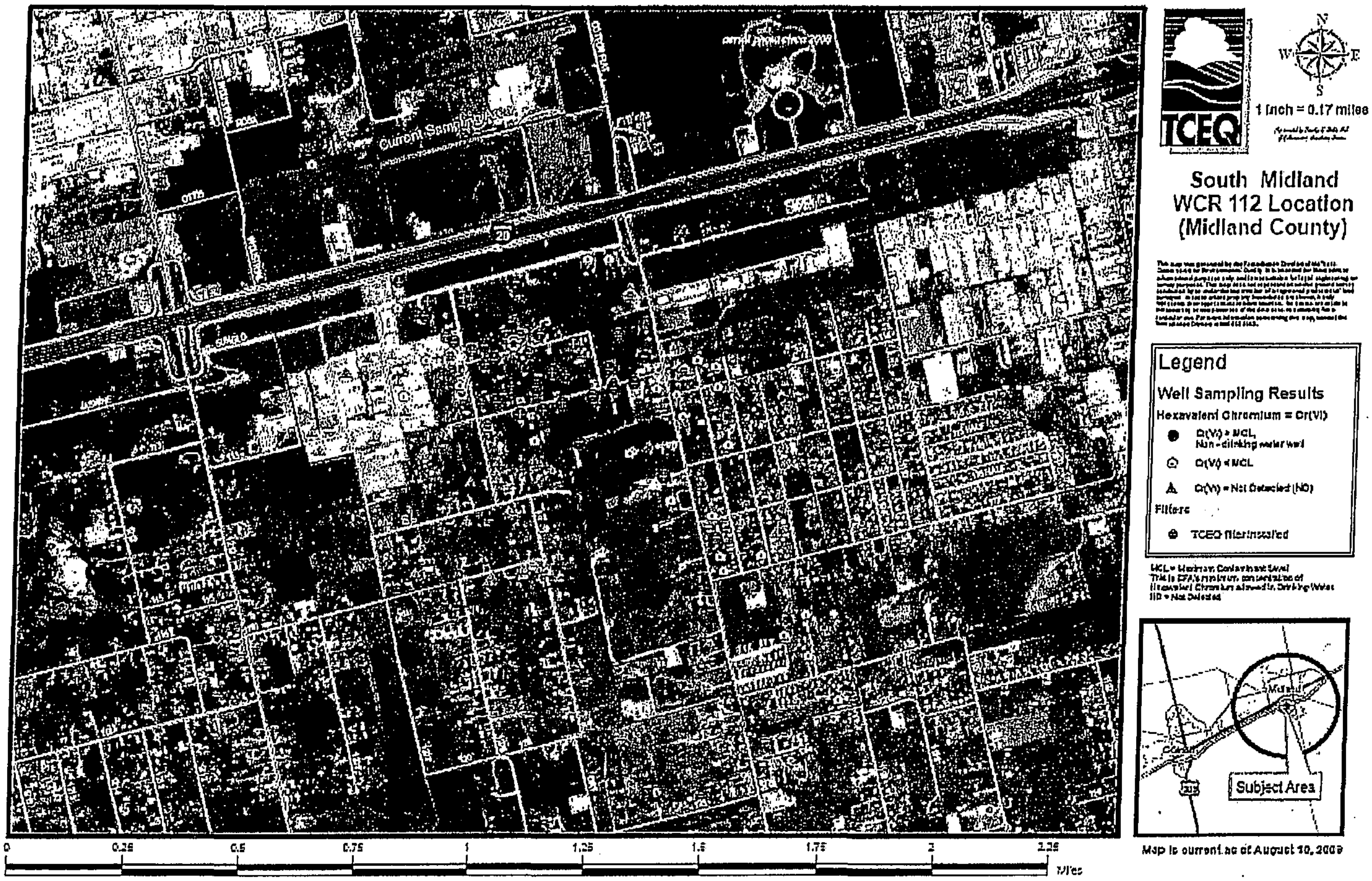


Figure 3.0: Previous West County Road 112 Water Well Results



Appendix A

Standard Operating Procedures

[*Insert the applicable SOPs referenced in the body of the FSP and listed in the table of contents for the FSP.*]

1.0 METHOD SUMMARY

This standard operation procedure (SOP) describes the steps necessary for site restoration. Upon completion of field activities, the site should be repaired to its original condition when possible. All drums or waste containers should be staged in a designated staging area and all other waste should be removed. All borings should be backfilled.

2.0 EQUIPMENT/APPARATUS/REAGENTS

Varies depending on which of the following tasks are completed.

3.0 PROCEDURES

1. Minimize impacts to work sites and sampling locations, particularly those in or near sensitive environments, such as wetlands with the use of soil erosion fences or by diverting streams/brooks during work operations.
2. Fill boreholes and pits, re-vegetate or erect erosion fences as necessary, re-establish streams, brooks, etc, as applicable.
3. Remove all sampling, decontamination equipment, and other items introduced to the site upon completion of work.
4. Remove all drums, trash, and other waste upon completion of work at the site.
5. Transport decontamination and/or purge water and soil cuttings to the designated locations.

4.0 CAUTIONS AND INTERFERENCES

This section is not applicable to this SOP.

1.0 METHOD SUMMARY

This standard operating procedure (SOP) provides standard operating procedures for managing investigative derived waste (IDW) generated during field activities. Materials which may become IDW include:

- Personnel protective equipment (PPE) including disposable coveralls, gloves, booties, respirator canisters, splash suits, etc.
- Disposable equipment including plastic ground and equipment covers, aluminum foil, conduit pipe, composite liquid waste samplers (COLIWASAs), disposable bailers, rope or twine, Teflon® tubing, broken or unused sample containers, sample container boxes, tape, etc.
- Soil cuttings from drilling or hand augering.
- Excess soil sample material.
- Drilling mud or water used for water rotary drilling.
- Ground water obtained through well development or well purging.
- Cleaning fluids such as spent solvents and washwater.
- Packing and shipping materials.

2.0 EQUIPMENT/APPARATUS/REAGENTS

2.1 Equipment List

- 55-gallon drums
- Labels for drums
- Wrenches for securing drum lids
- Marking pens (for marking on labels and on drums)
- Lumber (for creating storage area)
- Plastic sheeting (for storage area)
- Plywood (for storage area flooring)
- 5-gallon buckets
- Manifests
- Drum log

3.0 PROCEDURES

Be sure to keep all hazardous waste separate from non-hazardous waste. Label each container properly and keep a log (Appendix A) of all the drums or containers, stating their identification number and contents. Drill cuttings from different holes can be put in the same drums provided they originate from similar areas of the site (e.g., upgradient, background borings, etc.).

3.1 Management of Non-Hazardous IDW

1. If necessary, compact the waste into a reusable container, such as a 55-gallon drum to reduce the volume of non-hazardous waste.
2. If the waste is generated from an active facility, seek permission from the operator of the facility to place the *non-hazardous* PPE, disposable equipment, and/or paper/cardboard wastes into the facility dumpsters. These materials may also be taken to a nearby permitted landfill. On larger studies, waste hauling services may be obtained and a dumpster located at the study site.

3. Dispose of *non-hazardous* IDW such as drill cuttings, purge or development water, decontamination washwater, drilling muds, etc. in a unit with an environmental permit such as a landfill or sanitary sewer. These materials must not be placed into dumpsters.

4. Seek permission to place these types of IDW into the facility treatment system if the facility is active.

3.2 Management of Hazardous IDW

1. Properly contain and label all suspected or identified hazardous wastes. Wastes should be stored in labeled 55-gallon drums at a segregated staging facility with a secondary containment structure.

2. Take care to keep non-hazardous materials segregated from hazardous waste contaminated materials.

3. Review appropriate sample results to determine waste characterization and perform any specific analysis required by the permitted disposal facility.

4. Hazardous wastes may be stored on site for a maximum of 90 days before they must be manifested and shipped to a permitted treatment or disposal facility.

5. Dispose of hazardous IDW as specified in the USEPA and TNRCC regulations. If appropriate, place these wastes in an active facility waste treatment system.

6. Anticipate generation of hazardous IDW, if possible, to permit arrangements for proper containerization, labeling, transportation, and disposal/treatment in accordance with USEPA and TNRCC regulations.

4.0 CAUTIONS AND INTERFERENCES

1. All liquid and soil/sediment IDW *must* be containerized and analyzed before disposal.

2. The collection handling, and proposed disposal method must be specified in the site work plan.

APPENDIX A

DRUMMED MATERIAL WORKSHEET

Project Name	Project Number
Site Address	Project Manager

Drum No.	Boring No.	Date	Contents	Sample ID	Lab Results	Disposition

STANDARD OPERATING PROCEDURE NO. 1.5
DECONTAMINATION

1.0 METHOD SUMMARY

This standard operating procedure (SOP) provides a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations. This SOP does not address personnel decontamination.

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

2.0 EQUIPMENT/APPARATUS/REAGENTS

- Non-phosphate detergent
- Tap water
- Distilled or deionized water
- Long and short handled brushes
- Bottle brushes
- Drop cloth/plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- Pressurized sprayers
- Aluminum foil
- Ziploc® bags
- Trash bags
- Appropriate personal protective equipment (PPE)
- Face shield (for hard hat)
- High pressure washer (if necessary)
- Fuel for high pressure washer
- 55-gallon drums
- Plywood
- Sump pump
- Landscape timbers, 4 x 4's, or 2 x 4's

3.0 PROCEDURES

3.1 Decontamination

The prime contractor shall describe all decontamination of drilling equipment, well construction materials, sampling equipment, tools, etc in the project work plan. All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. This includes casing, drill bits, auger flights, the portions of drill rigs that stand above boreholes, sampling devices, and instruments, such as slugs and sounders. In addition, the contractor shall take care to prevent the sample from coming into contact with potentially contaminating substances, such as tape, oil, engine exhaust, corroded surfaces, and dirt.

The following procedures shall be used to decontaminate large pieces of equipment, such as casings, auger flights, pipe and rods, and those portions of the drill rig that may stand directly over a boring or well location or that come into contact with casing, auger flights, pipe, or rods:

1. Prepare the decontamination zone in accordance with SOP 1.2.
2. Don appropriate PPE.
3. Deposit the contaminated equipment on the plastic drop cloth/sheet or in a container inside the CRZ.
4. Place large pieces of equipment (e.g., auger flights) on sawhorses.

5. 'Use a high-pressure washer and a low-phosphate soap (e.g, Alconox) to remove encrusted material from grossly contaminated equipment. If necessary, use a brush to scrub the equipment until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., have been removed.
6. Rinse all equipment with potable water.
7. Store the equipment on sawhorses or wrapped in clean plastic sheeting.
8. Decontamination water should be collected and transferred to a 55-gallon drum at the end of the day or whenever significant quantities of water have accumulated. Drums of investigative derived waste (IDW) should be managed in accordance with SOP 1.4.

The following procedures shall be used to decontaminate small pieces of sampling equipment such as split spoons, bailers, trowels/spoons and bowls:

1. Prepare the decontamination zone in accordance with SOP 1.2.
2. Don appropriate PPE.
3. Scrub the equipment with a solution of potable water and low-phosphate soap (e.g., Alconox).
4. If organic constituents are contaminants of concern, rinse the equipment with a pesticide-grade solvent, typically acetone. If acetone is a constituent of concern, substitute methanol as the rinse agent.
5. Rinse the equipment with copious quantities of distilled or deionized water.
6. Allow the equipment to air dry on a clean surface or rack elevated at least two feet above ground.
7. Wrap the sampling device in aluminum foil or place in Ziploc® bags prior to reuse.

At the completion of the decontamination activities, all fluids and solid waste should be containerized and managed in accordance with SOP 1.4.

If a particular contaminant fraction is not present at the site, the ten (10) step decontamination procedure specified above may be modified for site specificity. For example, the solvent rinse may be eliminated if organics are not of concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

4.0 CAUTIONS AND INTERFERENCES

1. The use of distilled/deionized water commonly available from commercial vendors is typically acceptable for decontamination of sampling equipment.
2. The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.
3. If solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.
4. Damage can be incurred by solvent washing of complex and sophisticated sampling equipment.

STANDARD OPERATING PROCEDURE NO. 6.1
FIELD ACTIVITY DOCUMENTATION AND REPORTING

1.0 METHOD SUMMARY

This SOP provides requirements for documenting and reporting site activities. The objective of the documentation program is to accurately and completely describe all field activities, thereby demonstrating that all field activities are conducted in accordance with the project specific Field Sampling Plan or Field Work Plan and applicable Superfund Program Standard Operating Procedures (SOPs).

2.0 EQUIPMENT/APPARATUS/REAGENTS

Equipment typically required for documenting the progress of the project includes:

- Field logbook (all weather or water resistant)
- Field forms
- Camera
- Video recorder (if necessary)
- Permanent marking pens
- Ink pens (with waterproof, black ink)

The field logbook shall contain the following information at a minimum:

- Location, date and time of each activity
- Weather conditions (changes)
- Activity being performed
- Identity of the person(s) performing the activity
- The numerical value and units of any field measurements
- The identity of, and the calibration results for, each field instrument being used.
- All information required to demonstrate that the work is conducted in accordance with applicable Sampling Plans, Work Plans and SOPs
- visitors to the site

Specific information which shall be included for each sample includes:

- Sample type and sampling method
- The identity of each sample and depth(s) from which it was collected
- The amount of each sample
- Sample description (e.g., color, odor, clarity)
- Identification of sampling devices
- Identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged well casings)
- All information required to demonstrate that the work is conducted in accordance with applicable Sampling Plans, Work Plans and SOPs

All information relating to installation and development of monitor wells, installation of temporary groundwater sampling points, well development, well purging, groundwater sample collection and all other sampling activities or field work shall be recorded in a field logbook or field form(s). When field forms are used the field logbook shall reference the data noted on field forms and the field forms shall be dated and signed by the author. The field logbook will be bound with consecutively numbered pages and will be suitable for submission as evidence in legal proceedings. Each entry in the field logbooks will be signed and dated by the author. All original data recorded in the field logbook and other field forms will be written using permanent, waterproof ink. Errors made in the field logbook will be corrected by the individual making the entry by crossing a line through the error, entering the correct information, and dating and initialing the correction. The field logbooks and field forms will become part of the project file, and should be kept in the project file at all times when not in the possession of the field team.

3.0 PHOTOGRAPHS

General guidelines (all types of photos):

- If possible, use a camera that has a time and/or date stamp. Record the date and time each photo was taken on the photo or with the photo file (as applicable) and in the field logbook.
- Do not use special lenses (i.e., wide-angle lenses) as they can distort the image
- A brief, accurate description of what the photograph shows, including the name of the site and location shall be recorded in the field logbook.
- Include the name of the photographer, and witness, as applicable.

When photographs are taken the record of each frame exposed/recorded is kept in the bound field logbook along with the information above required for each photograph. The field investigator shall then enter the required information on the prints, slides or CD (if digital photos) using the photographic record from the bound field logbook, to identify each photograph.

<u>Conventional 35 mm Cameras</u>

- Obtain negatives in one continuous, uncut sheet and include with the pictures.
- Arrange photos in album format and include the above information for each photo and submit with the field logbook.

<u>Digital Cameras</u>

- Submit a CD-R of the downloaded picture files in JPEG format (include the above information for each photo) and submit with the field logbook.
- Digital camera recording mode (dependent on camera's pixel resolution quality and picture quality mode) shall be set to achieve a minimum pixel resolution of 1600 x 1200 or higher.

4.0 OTHER FIELD FORMS

Other types of records which may be used in the field include:

- Drum inventory forms
- Well development/purging records
- Boring logs
- Well construction diagrams (as-builts)

5.0 CAUTIONS AND INTERFERENCES

This section is not applicable to this SOP.

STANDARD OPERATING PROCEDURE NO. 6.3
COLLECTION OF VOC SAMPLES

1.0 METHOD SUMMARY

The objective of this standard operating procedure (SOP) is to provide guidance for the sampling of volatile organic compounds.

2.0 EQUIPMENT/APPARATUS/REAGENTS

Typical equipment required for groundwater, surface and subsurface soil sampling includes:

- Sample bottles with labels
- Hermetically sealed 40-ml VOA vials or hermetically sealed intermediate sample containers
- Coring device
- Stir bar
- Bailer (stainless steel or disposable)
- Scoop or spatula
- 2-oz. sample jars

Sample bottles for the collection of VOCs in groundwater will be preserved with hydrochloric acid.

3.0 PROCEDURES

3.1 Groundwater Sample Collection

The following procedures shall be followed in the collection of groundwater VOC samples:

1. Wells shall be purged in accordance with one of the following SOPs: SOP 7.2 (Monitor Well Purging with a Bailer), SOP 7.3 (Monitor Well Purging with a Pump), or SOP 7.3 (Monitor Well Micro Purging).
2. Label sample bottles in accordance with SOP 6.5 (Sample Handling and Control).
3. Care must be taken when filling a VOC bottle to direct a slow, steady stream of water down the side of the bottle to minimize aeration of the sample.
4. Fill the sample container to the top of the container so that a meniscus is formed. Allow any air bubbles to rise to the surface. Carefully and quickly screw the cap onto the container and finger tighten.
5. Invert the sample and tap it gently, looking for any air bubbles. If the sample contains air bubbles, discard the sample and repeat the sampling process with a new sampling container.
6. All samples must be properly packaged (SOP 6.5) and chilled to 4±2°C immediately upon collection.
7. During sample shipment, all conditions relating to the isolation/segregation of the samples from potential contaminants (gasoline/diesel engines or generators, highly contaminated samples, etc.) must be observed.
8. Decontaminate all non-disposable sampling equipment prior to moving to new sampling point and/or at the end of the day.

3.2 Soil Sample Collection

This section is based on the TCEQ Guidance on SW846-5035 and provides guidance for the implementation of Method 5035. The intent of Method 5035 is to collect the sample causing the least amount of disturbance to the soil structure and to transfer and hermetically seal the sample in a sample container as quickly as possible.

The recommended method of sample collection for both low and high concentration soils is the closed-system field collection using hermetically sealed 40-ml VOA vials or hermetically sealed intermediate sample containers. Three vials are needed for a regular sample, and 6 vials are need for a matrix spike/matrix spike duplicate sample (MS/MSD). Bulk sampling can be used for sample points where the contamination is expected to be high or where the procedure requires a sample volume that exceeds the recommended 5 grams, such as TCLP determination, or where a sample using Method 5035 procedures cannot be collected. Method 5035 includes a procedure for preparing low concentration samples, i.e., soil samples that can reasonably be expected to contain concentrations of VOCs between 5 μg/kg and 200 μg/kg, and a second procedure for high concentration samples, i.e., soil samples that are expected to contain greater than 200 μg/kg of VOCs.

It is recommended that screening of samples, both in the field using an appropriate field instrument, and in the laboratory using a gas chromatography screening method, be conducted prior to selecting the Method 5035 option. The selection of the appropriate analytical methodology depends upon the data quality objectives (DQOs) for the project. These DQOs include the analytical sensitivity requirements for the project and identification of the VOCs present, or suspected to be present, at the site.

3.2.1 Field procedures

This recommended sample collection technique does not require preservative.

1. All containers and sampling devices must be pre-cleaned and/or be certified free of VOCs.
2. The sample vial should be a standard supply 40-ml VOA vial with a PTFE (Teflon®)-lined septum that can be hermetically sealed.
3. Sample vials should be prepared in a fixed laboratory or other controlled environment. The tare weight of the sample vial including cap, septum, and label must be determined and recorded on the label prior to shipping the vials to the field for sample collection. Clean gloves should be worn when handling tared vials.
4. Exposure to air must be minimized by obtaining the sample directly from the sample source using a coring device or a commercially designed sampling device and by transferring the sample as quickly as possible to a 40-ml VOA vial (or sealing the sample borer/hermetically sealed sample container immediately). The 40-ml vial must be hermetically sealed immediately after placing the sample in the vial. The vial should be quickly wiped free of any particulate matter that would compromise the integrity of the vial seal. Fingers should be used to minimize exposure to air by forming a temporary seal between the vial and the sampling device. The coring/sampling device must be designed to fit tightly against the mouth of a tared 40-ml vial or be small enough to be inserted into the vial. The coring device can be used to collect multiple aliquots from the same sample point provided the integrity of the coring device is not compromised. If the coring device is designed and approved to be used as a temporary storage device for transport to the laboratory, the manufacturer's instructions should be followed. If a bulk sample is being collected because the concentrations in the soil are considered high, the 2 ounce sample jar should be filled to capacity to minimize the head space in the sample container.
5. The sample size collected should be approximately 5 grams (10 grams for TPH analysis by TCEQ 1005 and 1006). The coring device should be calibrated and designed to minimize the disturbance of the sample during collection. Several calibrated coring devices are available commercially. If the sampling team is not using a coring/sampling device that is calibrated to 5 grams, the TCEQ strongly recommends that, prior to collecting any samples, the sampling team practice collecting 5$\pm$ grams using the chosen sampling device and a balance as described in Section 6.2.1.4 of Method 5035. For non-cohesive soils and waste (e.g., dry sand, fly ash, etc.), for highly cohesive materials (e.g., concrete, rock, etc), and for soils that have high compressive and shear strength, the sample should be quickly transferred into a 2 ounce jar using a scoop or spatula. Enough sample should be collected such that the head space in the jar is minimized.
6. A bulk sample with no preservative should be collected to use for screening purposes in the laboratory, but not for quantitative analysis. After the sample is screened in the laboratory, the sample can be used to determine the percent moisture, to run the MS/MSD, to check reactivity with sodium bisulfate and/or to determine the appropriate extraction solvent, as necessary.

7. The entire sample is consumed during the analysis for low concentrations of VOCs. It is recommended that a total of three samples be collected at each sample point for a regular sample; allowing one sample for the analysis, one sample in case a dilution is required, and one sample for re-analysis, if necessary.

8. For the samples with high concentrations of volatiles, the sample is extracted with methanol and the extract is used for dilutions and/or re-analysis. Therefore, only two samples are recommended, one sample for analysis and one replicate for re-analysis, if necessary. If the VOC concentration is unknown, collect three samples as stated in number 7.

9. Six samples should be collected at each sample point for matrix spike/matrix spike duplicated (MS/MSD) sampling.

10. Sample containers remain unopened from the time of collection until analysis.

11. The use of a balance in the field is required to check the tare weight when field preservation with methanol is being conducted. For other sample collection procedures, balances are used to verify that an adequate volume (weight) of soil is collected, because the initial soil sample size will affect the quantitation limit that can be achieved on the sample.

12. All samples must be properly packaged (SOP 6.4) and chilled to 4±2°C immediately upon collection.

13. During sample shipment, all conditions relating to the isolation/segregation of the samples from potential contaminants (gasoline/diesel engines or generators, highly contaminated samples, etc.) must be observed.

14. Decontaminate all non-disposable sampling equipment prior to moving to another well and/or at the end of the day.

3.2.2 Quality Control

The laboratory quality control measures specified throughout Method 5035 must be followed. Field quality control measures should include a trip blank in every sample shuttle that contains samples for volatile analysis regardless of the sample collection technique.

4.0 CAUTIONS AND INTERFERENCES

4.1 Groundwater Sample Collection

Make sure that there are no air bubbles in the sample bottle. Be careful not to agitate the sample. The sample bottle should be quickly sealed and chilled, held at 4±2°C, and shipped to the laboratory.

4.2 Soil Sample Collection

The recommended method of sample collection for both low and high concentration soils is to collect the sample using a coring device and to quickly extrude the sample core into a tared 40-ml vial that does not contain preservative but does contain the stir bar, if applicable. The threads of the vial are inspected and wiped clean, and the vial is quickly sealed and chilled, held at 4±2°C, and shipped to the laboratory. The laboratory should analyze the sample within 48 hours from the time of collection. Alternatively, the laboratory can preserve the sample within the 48 hour time frame to extend the holding time to 14 days. The manual addition of any water, surrogates, and/or internal standards, and all additions of preservatives should be made using a 22-gauge or thinner needle through the septum seal. This collection procedure does not require the use of preservatives in the field or balances in the field. An alternative method is the collection of the sample using an approved coring device that serves as an intermediate hermetically sealed sample container. This type of sampling device should be used according to the manufacturer's instructions.

IHWCA 'Program Management Form'

DO NOT SEND THIS PAGE

(last revised 6/24/2009)

1. CA Facility ID No.	30813
Document due date:	8/14/09
Electronic file path of letter:	I:\EVERYONE\Adminsupport\ADMIN\RBryant\ 30813.Approval Remedy A.doc
Is this letter to be issued electronically by PM? *(Refer to RMD's eBusiness SOP to determine applicability)*	☐YES ☒NO
Internal (Blind Copy) Distribution: *(Enter Email address or Name, Office and Mail Code info &/or select appropriate default)*	Central Records (MC-199) IHWCA Reader Files (MC-127)
2. ARTS Communication ID(s):	12663809
This letter is *(select one)*:	APPROVAL
3. Status of *Entire* CA Site changed? (ARTs 'Legal' area update needed) *Select new status or 'NO' if no change*	NO (No changes to ARTs Legal area needed)
4. Status of a *'Specific Project'* for a CA Site changed? (ARTS 'Physical' area update needed) *Select new status or 'NO' if no change*	NO (No changes to ARTs Physicals needed)
If status update was needed, enter the *Name* of the project referenced in ARTs: →	
5. Does letter trigger a change in PTT Phase of case?	☒NO ☐YES (if *YES*, PM to update ARTs)
6. RCRA CA or CL Code update needed in RCRAinfo? *(check 'N/A' or 'Yes')* * *RCRA Codes are only required for tracking RCRA Facility Investigation (RFI) CA Units/Areas listed in a RCRA Permit & closures of RCRA Interim Status Units/Areas*	☐ N/A * (RCRA Codes 'Not Applicable' to site) ☐ YES (if *YES*, enter Unit Name and RCRA Code info below) ↓
Name of RCRA CA/CL Unit/Area(s):	
Select RCRA Corrective Action (CA) Code(s) for RFI Unit/Area: *(full code descriptions are posted on IHWCA TNET website)*	
Select RCRA Closure (CL) Code(s) for RCRA Interim Status Unit/Area:	

STANDARD OPERATING PROCEDURE NO. 6.4
SAMPLE HANDLING AND CONTROL

1.0 METHOD SUMMARY

This SOP presents procedures for maintaining control of environmental samples following collection through shipment to the analytical laboratory. In addition, this SOP describes standard chain-of-custody protocols which should be followed to document the possession of samples from the time of collection until the laboratory report is submitted.

2.0 EQUIPMENT/APPARATUS/REAGENTS

Equipment needed for use in this SOP includes:

- Precleaned sample containers
- Preservatives (if not in containers)
- Sturdy cooler, in good repair
- Fiberglass strapping tape
- Duct tape
- Clear tape
- Bubble wrap or other packing material
- Ziploc-type bags
- Trash bags
- Ice
- Shipping labels
- Pens, markers, etc.

3.0 PROCEDURES

3.1 Sample Identification

The contractor should identify procedures for unique sample identification and the relation to field identification (i.e., how sample numbers are assigned). Samples shall be uniquely identified, labeled, and documented in the field at the time of collection. Samples collected for laboratory analysis are identified by using standard sample labels which are affixed to the sample containers. Most analytical laboratories will supply the necessary labels. The following information shall be included on the sample label at the time of collection using waterproof, non-erasable ink:

- Project number
- Field identification or sample station number
- Date and time of sample collection
- Designation of the sample as a grab or composite
- Whether the sample is preserved or unpreserved
- The types of analyses to be performed
- Any relevant comments (such as readily detectable or identifiable odor, color, or known hazardous properties)
- Signature or initials of the sampler(s)

3.2 Sample Packaging

Environmental samples should be packed prior to shipment using the following procedures:

1. Allow sufficient headspace (approximately 10 percent of the volume of the container) in all bottles (except volatile organic analysis (VOA) vials with a septum seal) to compensate for any pressure and temperature changes which may occur during shipment.
2. Ensure that the lids on all bottles are tight.
3. Select a sturdy cooler in good repair. Secure and tape the drain plug with fiberglass strapping tape or duct tape. Line the cooler with a heavy duty plastic garbage bag.

4. Place glass sample bottles into bubble wrap bags or wrap a layer of bubble wrap around glass containers. Many laboratories provide bubble wrap bags for sample shipment. Place two to three VOA vials in a single bag.

5. Place the bottles in the cooler with larger bottles on the bottom inside the garbage bag. Insert polyethylene bottles between glass bottles for cushion. Put VOA vials (in bubble wrap bags) on their side on top of the larger sample containers.

6. Ensure that a trip blank has been included as appropriate for VOA samples and that a temperature blank (if supplied) is included as outlined in SOP No. 6.3, and SOP No. 6.5.

7. Place ice that has been "double bagged" on top of and/or between the samples. Fill remaining void space in the cooler with bubble wrap. Ensure that a sufficient quantity of ice has been placed into the cooler to maintain VOC samples at 4°C. In summer months, it may be necessary to fill as much as 50 percent of the cooler volume with ice to properly cool warm samples.

8. Securely fasten the top of the garbage bag with tape.

9. Place the Chain-of-Custody record into a Ziploc-type bag and tape the bag to the inside of the cooler lid.

10. Close the cooler and securely tape (preferably with fiberglass strapping tape) the top of the cooler shut. Chain-of-custody seals (preferably two) should be affixed to the cooler with clear tape so that the cooler can not be opened without breaking the seals.

11. Place the shipping label in a sealed pouch on the lid of the cooler for shipment. A label containing the name and address of the shipper and the destination should be placed on the outside of each additional cooler included in the shipment.

3.3 Sample Shipping

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible (within 24 hours of sampling) to avoid hold time exceedances and to ensure that samples remain properly preserved. Samples for VOC analysis must be maintained at a temperature of 4°C.

In general environmental samples include drinking water, most ground water and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, biological specimens, or any samples not expected to be contaminated with high levels of hazardous materials. Samples collected from process wastewater streams, drums, bulk storage tanks, soil, sediment, or water samples from areas suspected of being highly contaminated may require shipment as dangerous goods. Regulations for packing marking, labeling, and shipping of dangerous goods by air transport are promulgated by the International Air Transport Authority (IATA), which is equivalent to United Nations International Civil Aviation Organization (UN/ICAO). It is the responsibility of the shipper to ensure that shipments are made in accordance with all applicable laws, including contents and labeling.

3.4 Sample Chain-of-Custody

Procedures to ensure the custody and integrity of the samples should begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field laboratory records.

The contractor shall maintain chain-of-custody records for all field and field QC samples. A sample is defined as being within a person's custody if any of the following conditions exist:

- It is in their possession,
- It is in their view,

- It was in their possession and they secured it in a locked area, or
- It is in a designated secured area.

All sample containers shall be sealed in a manner that shall prevent or provide detection of tampering if it occurs. In no case shall tape be used to seal sample containers. Samples shall not be packaged with activated carbon unless prior approval is obtained from TCEQ.

The following minimum information concerning the sample shall be documented on the TCEQ chain-of-custody form (Attachment 1):

- Unique sample identification
- Date and time of sample collection
- Source of sample (including name, location, and sample type)
- Designation of matrix spike/matrix spike duplicate (MS/MSD)
- Preservative used
- Analyses required
- Number of sample containers
- Pertinent field data (pH, temperature, elevated headspace results or contaminant concentrations)
- Serial numbers of custody seals and transportation cases (if used)
- Name(s) of person(s) collecting the samples
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories
- Transporter tracking number (if applicable) or courier receipts

4.0 CAUTIONS AND INTERFERENCES

This section is not applicable to this SOP.

CHAIN OF CUSTODY RECORD

Project Name	Project No.
Project Location	Project Manager
Sampler(s)	

Sample		Type		Sample Identification	Matrix	Containers		Analytical Parameters										Remarks
Date	Time	Comp.	Grab			No.	Type											

Signatures	Date	Time	Shipping Details	Special Instructions
Relinquished by:			Method of Shipment	
Received by:			Airbill No.	
Relinquished by:			Lab Address	
Received for Laboratory by:				

Custody.frm/jdg 3-09-92

White copy - Laboratory

STANDARD OPERATING PROCEDURE NO. 7.3
PURGING A MONITORING WELL WITH A PUMP

1.0 METHOD SUMMARY

Purging is the process of removing stagnant water from a monitoring well, immediately prior to sampling, causing its replacement by groundwater from the adjacent formation, which is representative of actual aquifer conditions.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for purging groundwater monitoring wells a pump.

2.1 Equipment List

- Logbook
- As-built diagrams of monitoring wells
- Calculator
- Field data sheets
- 5-gallon buckets
- Plastic sheeting
- Generator, if using pump
- Air compressor for bladder pumps
- Pump
- Gasoline for generator/air compressor
- Discharge tubing for pump
- Control box (if necessary)
- Appropriate pump fittings (e.g., hose clamps, barbed fittings, etc.)
- Drums
- Marking pen for labeling drums
- Wrench for opening/sealing drums
- Appropriate PPE

3.0 PROCEDURES

1. Collect water level measurements as described in SOP 7.1 (Water Level Measurements).
2. Calculate the purge volume according to the following equation:

Volume = $[\pi \text{ (radius of borehole)}^2 \times 7.48 \text{ (gal/ft}^3) \times 0.3] - [\pi \text{ (radius of well casing)}^2 \times 7.48 \text{ (gal/ft}^3)]$

where:

π = pi (3.14, dimensionless)

7.48 gal/ft^3 = volume of water in an open borehole

0.3 = typical estimate of filter pack porosity (30%)

Knowing the diameter of the borehole, there are a number of standard conversion factors which can be used to simplify the equation above. The volume, in gallons per linear foot, for various standard monitor well diameters can be calculated as follows:

Well volume (gal/ft) = h x cf

where:

h = height of water column (feet), calculated by subtracting the depth to water (WL) from the total depth of the well (TD).

cf = the conversion factor shown on the table below.

Remember that you must use the *radius* in feet to be able to use the equation.

3. All non-dedicated equipment shall be decontaminated in accordance with SOP 1.5 (Decontamination) prior to sampling activities.
4. Assemble pump, hoses and safety rope, and lower the pump into the well. Make sure the pump is deep enough so all the water is not evacuated. (Running the pump without water may cause damage).
5. Make connections between the pump and control box if using an air-lift or bladder pump (i.e., Well Wizard).
6. Attach flow meter to the outlet hose to measure the volume of water purged.
7. Use a ground fault circuit interrupter (GFCI) or ground the generator to avoid possible electric shock.
8. Attach power supply, and begin purging the well. The well should be purged at a rate low enough to prevent water from cascading down the sides of the well, if at all possible. Do not allow the pump to run dry.
9. If the pumping rate exceeds the well recharge rate, lower the pump further into the well, reduce the pumping rate to decrease well drawdown, and continue pumping.
10. If using an air-lift or bladder type pump, be sure to adjust flow rate to prevent violent jolting of the hose as sample is drawn in.
11. Purge water shall be pumped into a container and dispose of as specified in the site specific sampling plan.
12. When no sediments are visible in the purge water, begin measuring field parameters in accordance with SOP 7.5 (Measurements of Monitor Well Field Parameters).
13. Purge the well until the purge volume has been achieved, and the well parameters have stabilized. As a general rule, all monitoring wells should be pumped or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan. Evacuation of a minimum of one borehole volume, and preferably three to five volumes, is recommended for a representative sample

4.0 CAUTIONS AND INTERFERENCES

The primary goal in performing groundwater sampling is to obtain a representative sample of the groundwater body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel. While laboratory methods have become extremely sensitive, well controlled and quality assured, they cannot compensate for a poorly collected sample. The collection of a sample should be as sensitive, highly developed and quality assured as the analytical procedures.

In a non-pumping well, there will be little or no vertical mixing of the water, and stratification will occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated, become stagnant, and may lack the contaminants representative of the groundwater. Persons sampling should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface resulting in an unrepresentative sample. To safeguard against collecting nonrepresentative stagnant water, the following guidelines and techniques should be adhered to during sampling:

1. Water level and sediment thickness measurements should be taken prior to beginning the purging activities.
2. As a general rule, all monitoring wells should be pumped (preferred) or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan.
3. A non-representative sample can result from excessive pre-pumping of the monitoring well. Stratification of the leachate concentration in the groundwater formation may occur, or heavier-than-water compounds may

sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

Materials of construction for samplers and evacuation equipment (bladders, pump, bailers, tubing, etc.) should be limited to stainless steel, Teflon, and glass in areas where concentrations are expected to be at or near the detection limit. The tendency of organics to leach into and out of many materials makes the selection of materials critical for trace analyses. The use of plastics, such as PVC or polyethylene, should be avoided when analyzing for organics. However, PVC may be used for evacuation equipment as it will not come in contact with the sample, and in highly contaminated wells, disposable equipment (i.e., polypropylene bailers) may be appropriate to avoid cross-contamination.

STANDARD OPERATING PROCEDURE NO. 7.5
MEASUREMENT OF FIELD PARAMETERS

1.0 METHOD SUMMARY

Field parameters are collected during surface water or groundwater sampling events to identify physical/chemical characteristics of the sample that are representative of field conditions as they exist at the time of sample collection. They are also used to indicate when stagnant water has been removed from the well so that sampling may begin. Numerous instruments are commercially available for measuring field parameters. The setup and use of all instruments should follow a basic format to imply consistency of use. Regardless of the brand of meter used, all meters should be properly maintained and operated in accordance with the manufacturer's instructions and calibrations should be checked prior to use.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for measuring field parameters:

2.1 Equipment List

- Logbook
- Field data sheets
- Decontamination solutions
- Tap water
- Field parameter instruments (pH meter, thermometer, conductivity meter, turbidimeter, DO meter)
- Calibration standards
- Tap water
- Non-phosphate soap (Note: Alconox is not considered a non-phosphate soap; rather a low-phosphate soap)
- Glass bulb thermometer

3.0 PROCEDURES

3.1 Temperature

Temperature is a measure of hotness or coldness on a defined scale as measured using a thermometer. Typical types of thermometers include:

- Digital (thermo-couple) thermistor
- Glass bulb mercury filled
- Bi-metal strip/dial indicator

No matter which type of thermometer is used, it should be calibrated prior to use, if possible. Digital thermometers should be calibrated prior to use by comparison with a mercury bulb thermometer and should agree within ± 0.5 °C.

The procedures for measuring temperature are as follows:

1. Clean the probe end with analyte-free water and immerse into sample.
2. Swirl the thermometer in the sample.
3. Allow the thermometer to equilibrate with the sample.
4. Suspend the thermometer away from the sides and bottom to observe the reading.
5. Record the reading in the field log book or on the appropriate sampling log sheet. Units of temperature are degrees Celsius (°C) and should be recorded to the nearest tenth (0.1).

Conversion Formulas:

$°F = (1.8\ °C) + 32°$ or $°C = 0.56\ (°F - 32°)$

3.2 pH

Hydrogen ion concentration (pH) is used to express both acidity and alkalinity on a scale which ranges from 0 to 14 with 7 representing neutrality.

The procedures for measuring pH in the field are as follows:

1. Calibrate the instrument in accordance with the manufacturer's specifications.
2. Collect a sample. Measure the temperature prior to measuring the pH.
3. Immerse the probe in the sample, keeping it away from the sides and bottom of the sample container. Allow ample time for the probe to equilibrate with the sample.
4. While suspending the probe away from the sides and bottom of the sample container, record the pH. Units of pH are standard units and should be recorded in tenths (0.1).
5. Rinse the probe with analyte-free water and store it in an analyte-free water filled container until the next sample is ready.
6. Perform a post calibration at the end of the day and record all findings.

3.3 Conductivity

Conductivity is defined as the quality or power of conducting or transmitting. The procedures for measuring conductivity in the field are as follows:

1. Calibrate the instrument in accordance with the manufacturer's specifications.
2. Collect the sample and check and record its temperature.
3. Correct the conductivity instruments temperature adjustment to the temperature of the sample (if required).
4. Immerse the probe in the sample keeping it away from the sides and bottom of the container. It is important that the entire portion of the probe be wetted by the sample. This will be evident when some of the sample water is seen coming out of the small weep hole.
5. Record the result in the field log book or field sampling sheet. Units of conductivity are micro ohms per centimeter (μohms/cm) at 25°C. Results should be reported to the nearest 10 units for readings below 1,000 μohms/cm and to the nearest 100 units for readings above 1,000 μohms/cm.
6. Rinse probe.

3.4 Dissolved Oxygen

Dissolved oxygen (DO) should be measured in-situ or "down hole" whenever possible. If in-situ measurements are not possible, precautions should be taken to minimize the time the sample is exposed to ambient air. Dissolved oxygen readings should not exceed the saturation limit of oxygen in water (8 to 10 mg/l). If readings greater than 10mg/l are observed, the meter is probably not functioning correctly. The procedures for collecting a DO sample are as follows:

1. Inspect the membrane of the DO meter for air bubbles and/or holes. If air bubbles or holes exist, replace the membrane.
2. Calibrate the DO meter in accordance with the manufacturer's specifications.
3. Measure the temperature of the sample and adjust the temperature setting of the DO meter, if so equipped.
4. Record the reading in the field log book or field sampling sheet. Dissolved oxygen is measured in units of mg/l. Results should be reported to the nearest tenth of a unit (0.1).

3.5 Turbidity

Turbidity is measured using a nephelometer/turbidimeter. The procedures for measuring turbidity are as follows:

1. Rinse the sample cell with analyte-free water.
2. Follow the manufacturer's specifications for collecting a turbidity measurement.
3. Record the reading in the field log book or field sampling sheet. The units of turbidity are nephelometric turbidity units or NTUs. Units should be recorded to the nearest whole unit.

4.0 CAUTIONS AND INTERFERENCES

Refer to owner's manual for instructions on proper calibration methods of all field parameter measuring equipment.

STANDARD OPERATING PROCEDURE NO. 7.7
GROUNDWATER SAMPLING USING A PUMP

1.0 METHOD SUMMARY

Most hazardous waste site investigations utilize some form of a groundwater sampling or monitoring program to fully characterize the nature and extent of groundwater contamination. In order to obtain a representative groundwater sample for chemical analysis it is important to remove stagnant water in the borehole or pump tubing before collection of the sample. This may be achieved using a variety of instruments including pumps and bailers. Once purging is completed and the correct laboratory-cleaned sample containers have been prepared, sampling may proceed. Sampling may be conducted with any of the above instruments, and need not be the same as the device used for purging. During sampling, a field data sheet should be completed, a chain of custody form prepared, and all pertinent data recorded in the site logbook. This SOP describes the procedures used for sampling a monitoring well with a pump.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for sampling groundwater monitoring wells using a pump.

- Field data sheets and sample jar labels
- Chain-of-custody forms/Custody seals
- Sample containers
- Knife or scissors
- 5-gallon buckets
- Plastic sheeting
- Shipping containers
- Packing materials
- Ziploc-type plastic bags
- Field parameter instruments (pH meter, thermometer, conductivity meter, turbidimeter, DO meter)
- Calibration standards
- Non-phosphate soap (Note: Alconox is not considered a non-phosphate soap; rather a low-phosphate soap)
- Generator, if using pump
- Air compressor for bladder pumps
- Pump
- Gasoline for generator
- Discharge tubing for pump
- Control box (if necessary)
- Appropriate pump fittings (e.g., hose clamps, barbed fittings, etc.)
- Appropriate PPE

3.0 PROCEDURES

This section outlines the procedures for collecting representative groundwater samples using the following steps: Each step in the procedure is covered in a separate SOP. The reference SOP is in parenthesis.

1. Refer to SOP 6.1 (Documentation), 6.3 (Collection of VOCs), 6.4 (Sample Handling and Control), and 6.5 (Collection of QC Samples).
2. Water level/sediment measurement will be taken in accordance with SOP 7.1 (Water Level Measurement)
3. Measurement of field parameters will be done in accordance with SOP 7.5 (Measurements of Monitor Well Field Parameters).
4. Purging will be done in accordance with SOP 7.2 (Purging a Monitoring Well with a Bailer) or SOP 7.3 (Purging a Monitoring Well with a Pump).
5. Allow well to recharge after purging to 90% of the static water level.
6. Assemble and label the appropriate bottles.

7. Set the pump height so that the intake is near the center of the screened interval.
8. Adjust the flow rate of the pump to minimize aeration and bubble formation. A flow rate of <0.5 L/min is typically appropriate. The pump discharge should produce a thin, continuous stream of water when filling the sample container.
9. Begin using the pump to fill the appropriate container. Samples should be collected in the following order:
   - Volatile organic compounds (VOCs)
   - Semi-volatile organic compounds (SVOCs); including polyaromatic hydrocarbons (PAHs)
   - Inorganic constituents (metals)
   - Mercury
   - Cyanide
   - Total organic carbon (TOC)
   - Total organic halogen (TOX)
   - Samples requiring field filtration
   - Samples for field parameter measurement
   - Samples for nutrient anion determinations
10. Filter and preserve samples as required by sampling plan.
11. Cap the sample container tightly and place pre-labeled sample container in a pre-chilled cooler.
12. Replace the well cap.
13. Log all samples in the site logbook and on the chain-of-custody form and label all samples in accordance with SOP 6.1 (Documentation).
14. Package samples and complete necessary paperwork in accordance with 6.4 (Sample Handling and Control).
15. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

4.0 CAUTIONS AND INTERFERENCES

Before sampling, monitoring wells shall be allowed to stabilize for a minimum period of 24 hours after development.

The primary goal in performing groundwater sampling is to obtain a representative sample of the groundwater body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel. While laboratory methods have become extremely sensitive, well controlled and quality assured, they cannot compensate for a poorly collected sample. The collection of a sample should be as sensitive, highly developed and quality assured as the analytical procedures.

Sample withdrawal methods require the use of pumps, compressed air, bailers, and samplers. Ideally, sample withdrawal equipment should be completely inert, economical to manufacture, easily cleaned, sterilized, reusable, able to operate at remote sites in the absence of power sources, and capable of delivering variable rates for sample collection. Wells should be sampled as soon as possible after purging (certainly no more than 24 hours) and should be sampled in order from least contaminated to most contaminated or from upgradient to downgradient if chemistry is unknown. Water levels shall be allowed to recover to 90% of the static water level before sampling. All nondedicated equipment shall be decontaminated in accordance with SOP 1.5 (Decontamination) prior to use or upon completion of the sampling activities.

TCEQ

STANDARD OPERATING PROCEDURE NO. 7.9
PURGING A DRINKING WATER WELL

Alan Batcheller, Director
Remediation Division

12/18/07
Date

1.0 METHOD SUMMARY

This standard operating procedure (SOP) is applicable to drinking water wells with a sealed wellhead. Purging is the process of removing water from the well bore which may not be representative of aquifer conditions. Purging a well is performed immediately prior to sampling, causing the replacement of water in the well bore with groundwater from the adjacent formation. This procedure allows for the collection of a representative sample(s) from the water bearing unit(s).

Drinking water wells typically have a sealed wellhead which prevents the use of a water level indicator. Without knowing the total depth of the well, the volume of water in the well cannot be calculated. However, if water level data and well construction records are available, the volume of water in the well bore can be used to estimate a purge volume in accordance with SOP 7.3 (Purging a Monitoring Well with a Pump). To ensure that an adequate volume of water is removed from the well to allow for the collection of a representative sample, the well is generally purged until consistent readings of field parameters are obtained. During purging, a field data sheet shall be completed, and pertinent information and observations shall be entered into the site logbook. Once purging is completed and field parameter values have stabilized, sampling may proceed.

1.1 ASSOCIATED SOPS

SOP 1.4 (Management of Investigative Derived Waste)
SOP 7.3 (Purging a Monitor Well with a Pump)
~~SOP 7.5 (Measurement of Field Parameters)~~
SOP 7.10 (Sampling a Drinking Water Well)

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a list of equipment typically used for purging a drinking water well.

- Site logbook
- Field data sheets
- Calculator

- Flow-Through Cell (and probes)
- Flow-Through Cell Apparatus (discharge tubing or hose, hose clamps, "Y" adaptor(s))
- Field parameter instruments: pH meter, thermometer, conductivity meter, turbidimeter, DO meter (Individual meters optional/Used in lieu of Flow-Through Cell and probes)
- Calibration standards
- 5-gallon buckets
- Drums
- Marking pen for labeling drums
- Wrench for opening/sealing drums
- Garden hose, minimum length 25 feet
- Appropriate PPE
- Camera (Optional)

3.0 PROCEDURES

1. Identify applicable components of the drinking water system between the wellhead and the point to be sampled. Observe the location(s) of exterior faucets, piping, pressure tank(s), water softener, filtration system, or multiple wells that may be connected/plumbed. Record in the site logbook a sketch of the system from the wellhead to the point the system enters the structure. If one or more points inside the structure are to be purged and sampled, extend the sketch to the point(s) sampled.

2. Locate the tap or faucet which is at, or nearest, to the wellhead (i.e., optimally prior to a water softener and/or filtration system) for purging and subsequent sample collection.

3. Record in the site logbook the location of the tap or faucet to be used for purging and sampling.

4. Calibrate the field parameter instruments in accordance with SOP 7.5 (Measurement of Field Parameters), or in accordance with manufacturer's specifications.

5. If the purge water is to be discharged onto the ground directly from the tap or faucet, determine if the purging will cause water to pool near the wellhead. If unsafe working conditions or damage to property could be caused by the purge water, attach one end of a garden hose to the faucet. Then, position the other end of the hose so that the purge water will safely drain away from the work area.

6. If the purge water is to be discharged into a 5-gallon bucket or drum, attach one end of the garden hose to the faucet. Then, position the other end of the hose so that the purge water will flow into the bucket or drum.

7. Open the tap or faucet so that the water flows at a high rate. Record the time that the purging begins in the field data sheet and the site logbook.

8. After the water has flowed for at least 15 minutes (or when the calculated purge volume has been achieved), collect measurements of pH, conductivity and temperature. Measurements of dissolved oxygen (DO), turbidity, oxidation reduction potential (ORP), or other parameters may be collected based on the approved site Field Sampling Plan or site-specific criteria. Collect all measurements in accordance with SOP 7.5 (Measurement of Field Parameters). Record the measurement collection time in the field data sheet and the site logbook.

9. While the water continues to flow, record field parameter measurements at intervals of no less than 5 minutes. Continue this procedure until three (3) consecutive measurements are consistent within the following specific tolerance limits:

pH	+/-0.5	(required)
conductivity	+/-10%	(required)
temperature	+/-0.5°C	(required)
dissolved oxygen	+/- 0.3 mg/L	
turbidity	+/-10% (> 10NTU)	
ORP	+/-10mV	

If field parameters have not stabilized after 3 successive readings (or, when the calculated well volume has been achieved), continue taking measurements at 3 minute intervals up to a maximum of 5 successive readings. If, after 5 successive readings, the parameters have not stabilized, an entry shall be made in the field logbook indicating that sampling will be conducted even though the field parameters are outside the specified tolerance limits.

10. Reduce the flow of water to disconnect the hose prior to sampling. Do not shut off the flow while disconnecting the hose.

11. Collect samples as described in SOP 7.10 (Sampling a Drinking Water Well) or in accordance with the approved site Field Sampling Plan.

12. ~~Shut off the water.~~

13. If purge waters have been collected for disposal, store and dispose of the purge waters in accordance with SOP 1.4 (Management of Investigative Derived Waste).

4.0 CAUTIONS AND INTERFERENCES

The primary goal in performing groundwater sampling is to obtain a representative sample of the water bearing unit. Samples collected for analysis can be compromised in the field by: (1) taking an unrepresentative sample, (2) handling the sample incorrectly, and/or (3) introducing foreign contaminants into the sample. Sample integrity can be optimized by following appropriate sampling protocol(s) and utilizing trained field personnel.

This purging procedure is intended for wells with a sealed wellhead. Do not open sealed wellheads.

STANDARD OPERATING PROCEDURE NO. 7.10
SAMPLING A DRINKING WATER WELL

Alan Batcheller, Director
Remediation Division

12/13/07
Date

1.0 METHOD SUMMARY

The objective of this standard operating procedure (SOP) is to provide guidance for the sampling of a drinking water well. Drinking water wells are sampled to determine the potential risk to human health and/or characterize the nature and extent of groundwater contamination. Drinking water wells typically have a sealed wellhead which prevents sampling directly at the wellhead. To collect a representative sample from the water well, use the tap or faucet located at, or nearest, to the wellhead. Using the tap or faucet, purge the well in accordance with SOP 7.9 (Purging a Drinking Water Well). Once the well is purged, collect the groundwater sample using a clean sample container which is appropriate for the intended analysis. During the sampling event, complete a field data sheet, and enter pertinent information and observations into the site logbook.

1.1 ASSOCIATED SOPS

SOP 6.1 (Field Activity Documentation and Reporting)
SOP 6.3 (Collection of VOC Samples)
SOP 6.4 (Sample Handling and Control)
SOP 6.5 (Collection of QA/QC Samples)
SOP 7.7 (Groundwater Sampling Using a Pump)
SOP 7.9 (Purging a Drinking Water Well)

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a list of equipment typically used for sampling a drinking water well:

- Site logbook
- Field data sheet
- Chain of custody forms
- Custody seals
- Sample containers/ cooler
- Sample preservatives (if sample aliquots are not pre-preserved)
- Sample container labels
- Shipping containers

- Ice
- Ziploc-type plastic bags
- Packing material
- ~~Appropriate PPE~~
- Disposable gloves
- Camera (optional)

3.0 PROCEDURES

1. Refer to SOPs 6.1 (Field Activity Documentation and Reporting), 6.3 (Collection of VOC Samples), 6.4 (Sample Handling and Control), 6.5 (Collection of QA/QC Samples), the approved site Field Sampling Plan, and the project Quality Assurance Project Plan (QAPP).

2. Purge the well in accordance with SOP 7.9 (Purging a Drinking Water Well).

3. Label the appropriate sample aliquots in accordance with SOP 6.4 (Sample Handling and Control).

4. Reduce the flow of water to prevent the formation of air bubbles in the sample container during sample collection.

5. Sample aliquots should be collected in the following order (as applicable):

   - Volatile organic compounds (VOCs)
   - Semivolatile organic compounds (SVOCs); including polyaromatic hydrocarbons (PAHs)
   - Inorganic constituents (metals)
   - Inorganic constituents (water quality parameters; cations/anions)
   - Mercury
   - Cyanide
   - Total organic carbon (TOC)
   - Samples requiring field filtration
   - Samples for field parameter measurement
   - ~~Samples for nutrient anion determinations~~

6. Filter (if applicable) and preserve samples in accordance with the approved site Field Sampling Plan. Do not preserve samples if the sample containers were preserved by the laboratory.

7. Fill the appropriate sample aliquots. For VOC samples, the sample aliquots should be filled to the top of the container so a meniscus is formed (SOP 6.3 Collection of VOC Samples). Avoid contact between the sample container and the faucet.

8. Carefully and quickly screw the cap onto the sample container and finger tighten.

9. Collect the appropriate QA/QC samples in accordance with SOP 6.5 (Collection of QA/QC Samples), or as required by the approved site Field Sampling Plan.

10. Complete the sample label information in accordance with SOP 6.4 (Sample Handling and Control) and place the labeled sample aliquots in a pre-chilled cooler.

11. Shut off the water.

12. Document the sample collection in accordance with SOP 6.1 (Field Activity Documentation and Reporting).

13. Complete the chain-of-custody form in accordance with SOP 6.4 (Sample Handling and Control).

14. Package all samples and paperwork in a shipping container in accordance with SOP 6.4 (Sample Handling and Control).

15. Transport or ship the sample container(s) to the analytical laboratory.

16. Restore the site following the applicable portions of SOP 1.3 (Site Restoration).

4.0 CAUTIONS AND INTERFERENCES

The primary goal in performing groundwater sampling is to obtain a representative sample of the water bearing unit. Samples collected for analysis can be compromised in the field by: (1) taking an unrepresentative sample, (2) handling the sample incorrectly, and/or (3) introducing foreign contaminants into the sample. Sample integrity can be optimized by following appropriate sampling protocol(s) and utilizing trained field personnel.

Wells should be sampled as soon as possible after purging and should be sampled in order from least contaminated to most contaminated or from upgradient to downgradient if the chemistry is unknown.

1.0 METHOD SUMMARY

TCEQ requires the use of Global Positional System (GPS) in conjunction with other technologies to collect and maintain positional data that provides physical and environmental site information about plume and contaminate changes over time. Also GPS technologies are used to provide the boundaries of buildings, real property, waste areas, locations of wells and other relevant site features.

2.0 GPS CERTIFICATION

To ensure that TCEQ receives reliable and accurate positional data, TCEQ OPP 8.12 requires that the GPS data collector must be certified. The TCEQ staff may obtain GPS certification by attending a training course presented by either an internal GPS trainer or by a manufacturer-certified GPS trainer. Non-TCEQ staff may obtain GPS certification from a manufacturer-certified GPS trainer. All GPS data collectors must verify that the certification instruction they have received meets the minimum elements listed in Table 1 - GPS Certified Training Minimum Elements in the Third Party GPS Training Certification section of this SOP.

3.0 EQUIPMENT/APPARATUS

A DGPS (Differential Global Positioning System) receiver can be either a stand alone unit, or a GPS module with Differential GPS antenna and relevant satellite subscription, plugged into a portable computer. The DGPS receiver must:

- Have six channel parallel reception or better.
- Have sub-meter horizontal accuracy.
- Employ these processing parameters:

Position acquisition rate	-	1/second or better
Position mode	-	3D (uses 4 satellites)
Maximum PDOP	-	6(or less)
Minimum Elevation	-	User-Selectable (record elevation accuracy)

- Have the ability to perform real-time differential correction (no post processing).
- Receive correction data from a recognized, reliable source, and which is appropriate for real-time correction in the geographic area in which the GPS measurements will be made.
- Output correction data in RTCM-SC104 (Radio Technical Commission of Maritime Service - Special Committee Paper No.104) format via an RS-232 cable or other compatible connection which matches the DGPS receiver.
- Have ability to store at least 180 position measurements.
- Have ability to transfer almanac and position data to a personal computer via a serial port or USB connection.
- Include software to perform mission planning, differential correction, point data averaging, and conversion to common formats (Grid or ArcView).
- Have a water and shock resistant case.
- Include portable power source(s) which will last a full working day.
- All weather proof Field Log Book.
- A laser rangefinder (optional)

4.0 GPS DATA COLLECTION AND ACCURACY

Horizontal Accuracy - All horizontal positions collected using certified GPS units shall maintain sub-meter accuracy. In order to meet sub-meter accuracy, latitude and longitude coordinates should be carried out to at least 6 places for decimal degree and at least 2 place for decimal seconds.

DGPS - Differential Global Positioning System (DGPS) receiver which corrects the atmospheric effects. DGPS are used for realtime GPS mapping and tracking without the need for post-processing.

PDOP - Positional Dilution of Precision. A measure of the quality of a GPS measurement taken from a given set of four satellites at a given time. If the satellites are not widely distributed from the user's location, the PDOP value will be higher, and the quality of the measurement will be diminished. PDOP values greater than 6 are not acceptable.

Datum - A mathematical model used by cartographers to define the shape of the earth in a specific area. Always use North America Datum of 1983 (NAD 83).

Differential Correction - A process applied to raw GPS data that removes certain types of errors; primarily, the error introduced by Selective Availability. This process requires correction data from a reference GPS receiver operating from a precisely known location. Correction data must be obtained from a recognized, reliable source (such as the reference network maintained by the Texas Department of Transportation) or Racal LandStar, and certain Trimble units, provide a satellite delivered GPS correction service, which provide 24 hour accurate and reliable real time precise positioning on land and in the air. For full coverage in Texas, the differential signal is transmitted to the user by high-power geostationary satellites. The GPS and differential signal are both received by the GPS via a single antenna.

A single position reading obtained through appropriate use of real-time correction must have sub-meter accuracy.

Collection Methods - GPS data may be collected using one of three methods:

- Superimposed - The superimposed method involves standing on top of or next to the subject for which you are collecting GPS locational data. Collect 60-100 readings.
- Centroid - The centroid method is used when the superimposed method cannot be used (e.g. well inside a locked fence or structure). Take points equal distance from the desired point by starting and stopping the GPS and by averaging these points. The unit will average the point for each reading and then all the points as one point which will be the center of all the readings. Collect a minimum of 30 readings per point prior to averaging.
- Offset - The offset method is used when the superimposed method cannot be used and only when accurate offset measurements can be made (e.g. Using a laser rangefinder, tape measure, etc.) The potential error associated with the offset measurement must be added to the potential error associated with the GPS measurement. A note in the GPS logging software and the field log book of bearing and distance from the offset location can be used but location must be corrected before it is entered into a table or shape file.
- Points - The point is used for well and sample locations, gates, sub-meter objects, etc.
- Line - The line is used for trail, road, stream, berm, etc.

- Polygon - The polygon is used for buildings, site boundary, waste area, ponds or piles, etc. If it is hard to walk the entire perimeter, readings can be taken at each corner of the polygon by starting and stopping the GPS at the corners and within the same Station. The program will add the line in between the points of the Station to create a polygon.

5.0 DATA SUBMITTALS

Correction Status - All GPS data submitted must have a field indicating each record's differential correction status. There are only two selections available:

- Differential Correction - Indicates that the record has been differentially corrected.
- Uncorrected - Indicates that the record has not been differentially corrected.

Offset - The offset points must be noted in the field log book and actual points calculated before entering the station into the final database or shape file.

Events - Each event must be in separate data table or shape file.

Data Sets - Each data set must be in separate file or layer (e.g All wells, buildings, site boundaries, sample results/event, site features, roads, trails, utilities, etc. must be in separate layers/tables).
Arc View files - All data must be in Decimal Degrees, NAD 83 exported to Arc View 3.2 as a shape files with the relevant metadata, a hard copy of the Arc View tables must accompany the electronic version for TCEQ submittal.

Field Log Book - Site name location and details of field activity must be noted in the field log book, including the name and coordinates of each station and bearing and distance details describing any station off-sets.

Minimum Attributes - All GPS data submitted to TCEQ should conform to the data attributes defined in Table 1.

Table 1
GPS Data Attributes

Attribute	Data Type	Field Length	Description
Latitude	Number	Double	Decimal Degree to a minimum of six decimal places
Longitude	Number	Double	Decimal Degree to a minimum of six decimal places
Site Name	Text	50	Superfund Site Name
Station Name	Text	50	Monitoring well number or Sample name
Station Reference / Comments	Text	50	Station Location Relative to Facility
Station Type	Text	10	Point, Line or Polygon
Collector Name	Text	50	Last Name, First Initial
GPS Certificate Number	Text	8	TCEQ GPS Certificate Number
Collection Method	Text	15	Superimposed, Centroid, Offset
Datum	Text	5	Horizontal Datum (NAD27, NAD83 or WGS84)
Max PDOP	Number	Single	Maximum PDOP value in effect during data collection (not > 6)
Receiver Type	Text	50	GPS model name & accuracy
Correction Status*	Text	50	Tells whether or not GPS data was differentially corrected
GPS Date	Date	N/A	Date GPS data was collected
GPS Time	Text	8	Time GPS data was collected
Total Positions Collected	Number	Integer	Number of positions collected/corrected

* Data that is not differentially corrected will be rejected.

Data Format - GPS data submitted to TCEQ should be in electronic format (dBASE IV, .dbf file format is preferred). The following is an example of how the data table should be structured. The data may be submitted via email, on diskette, or CD.

Table 2
Third Party GPS Data
Example Data Table

Latitude	Longitude	Site Name	Station Name	Station Reference/ Comments	Collector Name	TCEQ GPS Certificate Number	Datum	Collection Method	Max PDOP	Receiver Type	Correction Status	GPS Date	GPS Time	Total Positions
11.111000	99.999000	Pioneer	MW-21	NW Corner	Terry, D	95081107	NAD83	Superimposed	4.4	Trimble XRS DGPS	Differential Correction	5/22/00	10:10 AM	61
11.111100	99.999100	Pioneer	MW-22	Center of the facility	Terry, D	95081107	NAD83	Centroid	5.2	Trimble XRS DGPS	Differential Correction	5/22/00	10:25 AM	108
11.111200	99.999200	Pioneer	MW-23	S of entrance	Terry, D.	95081107	NAD83	Superimposed	3.5	Trimble XRS DGPS	Differential Correction	5/22/00	1:38 PM	66
11.111200	99.999200	Pioneer	site location	South Entrance of facility	Terry, D.	95081107	NAD83	Superimposed	3.5	Trimble XRS DGPS	Differential Correction	5/22/00	3:38 PM	60

Third Party GPS Training Certification
Minimum Qualifications
Texas Natural Resource Conservation Commission

TCEQ OPP 8.12 requires all GPS training courses to include both lecture/classroom discussion and hands-on exercises. Table 1 contains the minimum elements that must be included in any TCEQ-recognized GPS certification training course

Table 1
GPS Certification Training
Minimum Elements

Minimum lecture and/or demonstration elements	Minimum hands-on exercises, to be successfully completed by each student
☐ Background of the Global Positioning System. ☐ GPS accuracy issues. ☐ Relevant Agency operating policies. ☐ Operation of GPS equipment, including basic troubleshooting. ☐ Data collection procedures. ☐ Differential correction, both real time processing and post processing. ☐ Coordinate averaging for point locations. ☐ Data output in formats appropriate for import to GIS or tabular databases.	☐ Pre-planning, including data quality objectives, equipment and materials needed, logistics of field data collection, and prediction of GPS data collection conditions. ☐ Navigation to a given coordinate. ☐ Storing and transferring raw positional data. ☐ Differential correction of raw data through post processing. ☐ Averaging corrected point data and outputting to a GIS file.
Class exercises shall also include computer plotting of point data to allow students to better understand GPS accuracy issues and the effects of differential correction and point data averaging	
Note: All certified GPS users recognized by TCEQ must be recertified every 2 years; • Sales or user demonstrations do NOT constitute GPS training; • GPS training courses should last a minimum of six to eight hours; • The TCEQ GPS operating policy is available online at: http://www.tceq.state.tx.us/gis/gisplcy.html	

Individuals obtaining or with current GPS certification training must verify that the instruction they have received meets the minimum elements listed in Table 1. Therefore, fill out the attached form, along with copies of GPS training certificates, and return them to:

David P. Terry
TCEQ GPS Coordinator (MCC-155)
SWAP Team
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087
(512) 239 4755
Email: dterry@tceq.state.tx.us

GPS Certification Verification Form
Texas Commission on Environmental Quality

Contact Information					
GPS Training Coordinator Information			**Training Provider Information**		
Name			Organization Providing GPS Training		
Organization			Instructor		
Mailing Address			Course Name		
City	State	ZIP	Course Date	Course Hours	
Email Address			GPS System (e.g. Trimble, Magellan, etc.)	Manufacture Yes ☐	No ☐

The following individual(s) have received GPS certification training that complies with TCEQ OPP 8.12 minimum training elements:

Name	Title

I hereby state that the information provided is true, accurate, and complete to the best of my abilities

Signature of GPS Training Coordinator or GPS Trainer | Title | Date

Printed Name | Telephone Number | Extension